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Inquiry on Federal
Water Policy

Enquête sur la politique
fédérale relative aux eaux

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SAFEGUARDING CANADIAN DRINKING WATERS

by

Brian Grover and David Zussman

Canada

Inquiry on Federal Water Policy
Research Paper #4

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March 1985
Ottawa

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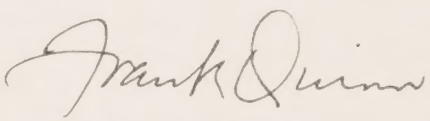
THE INQUIRY ON FEDERAL WATER POLICY

The Inquiry on Federal Water Policy was appointed by the federal Minister of the Environment in January of 1984 under the authority of the Canada Water Act. The members were Peter H. Pearse, chairman; Françoise Bertrand, member; and James W. MacLaren, member. The Inquiry was required by its terms of reference to review matters of water policy and management within federal jurisdiction and to make recommendations.

This document is one of a series of research papers commissioned by the Inquiry to advance its investigation. The views and conclusions expressed in the research papers are those of the authors. Copies of research papers and information on the series may be obtained by writing to the Enquiry Centre, Environment Canada, Ottawa, Ontario K1A 0H3.



Frank Quinn
Director of Research

Abstract

The report provides an overview of the drinking water situation in Canada, with particular focus on water quality issues and the respective roles of various levels of government. Considerable background information is provided on the evolution of water supply and wastewater systems, the health implications of changes in drinking water quality, the legislative and regulatory framework and relevant programs of the federal government. Experience in the USA, which has had a Safe Drinking Water Act since 1974, is reviewed. Following a review of drinking water issues and federal options, the report concludes with seven recommendations for action by the federal government. The report strongly emphasizes the need for the federal government to co-operate with provincial and local governments in order to safeguard Canadian drinking waters.

Résumé

Ce rapport donne un aperçu de la situation de l'eau potable au Canada en apportant une attention particulière aux questions de qualité des eaux et aux rôles respectifs des différents palliers de gouvernement. Une quantité considérable d'information de fond est fournie sur l'évolution des systèmes d'approvisionnement en eau et des systèmes de traitement des eaux usées, sur les répercussions sur la santé des changement dans la qualité de l'eau potable, sur l'encadrement législatif et réglementaire, et sur les programmes gouvernementaux fédéraux reliés à l'eau potable. L'expérience des États-Unis, qui a adopté une loi sur la sureté de l'eau potable en 1974, est passée en revue. Faisant suite à une révision des questions d'actualité reliées à l'eau potable et des options fédérales possibles, ce rapport se termine par sept recommendations sur des actions à être posées par le gouvernement fédéral. Ce rapport souligne énergiquement le besoin pour le gouvernment fédéral de coopérer avec les gouvernments locaux et provinciaux afin de protéger les ressources en eau potable canadiennes.

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EXECUTIVE SUMMARY

Canadians have learned from experience that the water they drink generally meets their expectations. Although there are pockets of concern in parts of the country, we have as a nation not been very bothered by the quality and quantity of our drinking water. Mortality and morbidity rates have steadily declined over the decades to the point where urban dwellers have little fear of being killed by the diseases which so harshly attacked earlier generations and which, to this day, savage the lesser developed countries of the world. Despite these significant advances, microbiological pathogens remain a constant threat in public water supplies in Canada, with several outbreaks and several thousand cases of waterborne diseases annually. Constant vigilance is required to minimize the risks of waterborne disease.

In recent times, particularly the past twenty years, we have become aware of some unpleasant side effects of our economic development as our scientists have discovered increasing numbers of chemical contaminants, mostly at very low concentrations, in the water sources which we utilize for our drinking water supplies. laboratory experiments, indicate that many of these substances appear to threaten our health but the magnitude of these risks is uncertain and we have little evidence at present of human suffering caused by such chemicals in our water supply. People are naturally concerned by the existence of such micro-contaminants in water sources and are looking to governments for comfort in the face of such uncertainty. Analyzing these perceived problems requires research which is complex, expensive and time consuming.

This report attempts to study the role the federal government might play to safeguard Canada's drinking water supplies. We have attempted to propose recommendations which are pragmatic and are sensible in light of existing institutional structures and relationships among the various levels of government. We have also deliberately made suggestions as to the federal government's activities in this policy area, despite the fact that drinking water is essentially a provincial area of jurisdiction. This is because the Inquiry on Federal Water Policy focusses specifically on the responsibilities of the federal government. Such an approach is consistent with other federal policy initiatives which have been developed over the years to complement and support provincial areas of responsibility.

Water supplies in Canada are mostly provided by local authorities, municipal and regional governments, which in turn get their main technical and financial support from the provincial governments. These same local authorities are usually responsible for the systems which dispose of the wastewaters created by the water supply systems. The water supply and wastewater industry in Canada employs up to 60,000 people, mostly in local authorities, and invests some $ 2 billion annually in system construction.

Most of the limited research into water quality problems in Canada is not carried out by local authorities but by provincial and federal government departments. It is the political leaders of these two levels of government to whom citizens ultimately turn when concerned about the health implications of drinking water quality.

The federal government cannot, for various reasons, provide the assurances about drinking water quality which the public seeks. First, for constitutional reasons the federal government is not responsible for the individual water supply systems or water sources. Secondly, reliable information about the quality of untreated and treated waters is generally collected locally by various water supply, public health and environmental officials, and most of the resulting analyses are not preserved provincially or nationally. Thirdly, as mentioned earlier, the health impacts cannot be predicted confidently because of the lack of conclusive, applied research on these matters. Finally, the federal government is poorly organized and staffed to provide a national overview on drinking water problems. This in turn relates to the first point, the federal government's limited responsibilities in this field.

The United States Congress passed a Safe Drinking Water Act in 1974 which assigned responsibility to the federal government, specifically the Environmental Protection Agency, for research, for setting legally enforceable water quality standards and for enforcing these standards in situations of imminent hazards to public health. The state governments have the basic responsibilities to ensure that public water supplies comply with applicable standards, including monitoring and publishing water quality results. In Canada only the province of Quebec has drinking water quality standards which are legally enforceable.

There is a need for municipal, provincial and federal governments to work together to ensure that people in all parts of Canada are reliably provided with drinking water which is palatable and does not in any way jeopardize their health. The federal government can provide leadership and support in some areas but can achieve little by working unilaterally. This report reviews the water supply situation in Canada and highlights twelve issues of concern, along with federal government options for dealing with each issue.

After summarizing our conclusions, including suggestions for the federal government's limited role in this sector, we recommend that the federal government act to safeguard Canadian drinking waters, as follows:

1. *Issue a policy statement which clearly enunciates the federal government role in water supply and wastewater disposal.*

2. *Take steps to rationalize all federal activities concerning water supply and water pollution control.*

3. *Complete a comprehensive report, with the cooperation of the provinces, on the present status of drinking water supplies in Canada and maintain an improved national data base on these matters.*

4. *Increase federal financial support for applied research concerning water supply and pollution control in the context of a comprehensive national research program.*

5. *Cooperate with the provinces in the production of national guidelines for the quality of water sources before treatment and drinking water after treatment, following which these guidelines should be made enforceable standards in areas of federal jurisdiction.*

6. *Increase financial support to training programs initiated by the provinces and the water supply industry.*

7. *Be prepared to loan funds to help finance the capital costs of constructing and rehabilitating water supply and wastewater systems.*

We recommend that implementation of these recommendations begin in 1985 and we provide specific suggestions in this regard. Finally we suggest that the federal government should initiate an annual working meeting with provincial, municipal and industry representatives as an ongoing mechanism to facilitate federal cooperation in this sector.

It is our hope that the research report will be a useful contribution to the final report of the Inquiry, to possible federal legislation which the government has suggested and, ultimately, to the improved health and well being of all Canadians.

1.0 INTRODUCTION

Water is essential for human life. Some 65% of an average person's body weight consists of water and to stay alive one needs a reliable supply of drinking water which must be of such quality that it does not jeopardize health.

On November 10, 1980 the United Nations designated the period 1981-1990 as the International Drinking Water Supply and Sanitation Decade. The basic goal was to provide access for all people to these basic services by the year 1990.

Over the years Canadians have played instrumental roles in enunciating this global approach. "Fresh water for all by 1990" was the target first expressed at the United Nations Conference on Human Settlements (HABITAT) which met in Vancouver in 1976. The following year Canada sent a 25 person delegation to the United Nations Water Conference at Mar del Plata in Argentina. The Canadian delegation reportedly played a major role in shaping the conference proposal for the International Drinking Water Supply and Sanitation Decade which is now underway.

The provision of reliable supplies of safe drinking water has always been a major concern for Canadian individuals, community leaders and governments. Public participation during 1984 in the Inquiry on Federal Water Policy confirmed that Canadians continue to be concerned about their drinking water. Of the 256 submissions received by the Inquiry up to December 15, 1984, at least 45 included references to drinking water supplies. Individuals and groups from the private and public sectors in all parts of Canada offered their views on this critical topic. The most significant themes from these submissions are being summarized by research staff of the Inquiry. The final report of the Inquiry, due later in 1985, is expected to incorporate these themes.

This research report attempts to provide an overview of the drinking water situation in Canada, with particular focus on water quality issues and the respective roles of various levels of government. In particular we have been asked to consider alternative actions which might be taken by the federal government as well as the implications of such actions.

The logic of the report is evident from the Table of Contents. Chapter Two provides some background on the responsibilities for providing water supplies and on the existing systems. The third chapter reviews the roles of the federal government in Canada and the fourth chapter looks at USA experience in managing drinking water. Canadian drinking water supply issues and federal options are examined in the fifth chapter. The sixth chapter provides our conclusions and the final chapter provides recommendations for action by the federal government. We have chosen to offer such recommendations, along with suggestions for their implementation, in order to focus attention on the limited but nevertheless important role which we believe can be constructively played by the federal government in safeguarding Canadian supplies of drinking water.

Limitations of time and budget precluded any original research for this report. Extensive use has been made of available information, with references indicated throughout the text and listed at the end. Readers desiring more detailed information should refer to the documents cited and review the submissions and transcripts of the Inquiry hearings.

The draft report was researched and written in December 1984 and January 1985, following which it was circulated for comments to selected reviewers. We wish to record the generous assistance provided in this manner by Roy Hickman, Richard Tobin and colleagues at the Bureau of Chemical Hazards, Department of Health and Welfare; Ralph Pentland, Bill Traversy and colleaques of the Inland Waters Directorate, Environment Canada; Jim Kingham and colleagues in the Ontario Region of Environment Canada; Dave Hay and Marc Boivin of the Environmental Protection Service of Environment Canada; H. L. Nylund of the National Office, Canada Mortgage and Housing Corporation; Steve Bonk, Regional Municipality of Ottawa-Carleton (also Chairman, General Policy Council, American Water Works Association); Frank Quinn and Bernard Madé, Inquiry staff; and Jakob Diddens and Jim Kirch of R.L. Walker & Partners Ltd. in Edmonton.

Administrative and secretarial support was efficiently provided by Dilshad Karim.

The authors alone remain responsible for the analyses, opinions, recommendations and any possible deficiencies in this final report.

2.0 BACKGROUND

This chapter provides basic information on how drinking water supplies are provided in Canada and some data on existing systems.

2.1 Drinking Water, Other Water Supplies and Wastewater Disposal

A typical Canadian consumes, on average, about two litres of drinking water daily[1]. Less than half of this daily intake is consumed directly as water. The rest is used in other beverages made with tap water (such as coffee, tea, soups, etc.). People get additional water from bottled beverages (soft drinks, beer, wine, etc.) and from water present in solid and semi-solid foods.

The vast majority of Canadians obtain their drinking water from municipal systems which provide water which is used in their homes for a variety of purposes. Average demands from municipal systems are typically 500 litres per capita daily[2], which is several hundred times the quantity required for drinking water purposes. Most of the water is used for washing, toilet flushing, gardening, firefighting and the like. Since we use such a relatively small portion of our total water supply for drinking, this water could be obtained separately from our normal municipal supplies. In fact some people choose to drink bottled water. In 1980 Canadians were reported to have bought $ 25 million worth of bottled water[3].

Drinking water quality forms only a small part of the larger water quality issue. For purposes of this report, we are concerned primarily with the quality of water at the place of use; that is, at the point in the home or commercial establishment where the water is provided.

Questions about the quality of drinking water have to be considered in the context of the various systems by which the water reaches the consumer. It is also appropriate to consider water supply and wastewater disposal systems concurrently because both affect water quality and public health directly. The water cycle involves continuous circulation and frequent reuse of water so that wastewater from one system often becomes at least part of the source for another drinking water system. Furthermore the same organizations frequently are responsible for aspects of both water supply and wastewater disposal. This paper, accordingly, examines drinking water in the broader context of water supply and wastewater systems.

2.2 Evolution of Canadian Water Supplies and Drinking Water Quality

Before examining the legislative framework and the water supply systems which exist today we provide a brief historical perspective on how drinking water quality has changed over time in Canada. A comprehensive history of drinking water quality is obviously beyond the scope of this research report but an overview may be helpful. Readers interested in pursuing this topic in depth are referred to the sources we have used, although we note there is more historical information available about the experience in the USA than in Canada.[4][5][6][7]

Canada's native peoples and the early immigrants invariably sited their dwellings near drinking water sources. Finding such naturally available supplies of water was relatively easy because of the abundance of water resources in most parts of Canada. Water quality depended on the natural properties of water in the lakes, rivers, springs or shallow wells. Incidences of water related disease increased as the population grew and polluted the waters. People did not know that drinking water could be contaminated and cause illness or death until some 125 years ago. In 1849 in England, Dr. John Snow discovered the link between cholera and the fecal contamination of drinking water, following an epedemic which had claimed some 250,000 lives between 1845 and 1849.

With modernization came urbanization, resulting in increasing numbers of people living together in communities. Obtaining a supply of water became more difficult as the individuals built dwellings further away from natural sources. At one stage many urban residents relied on water carriers to fetch and transport water which was sold by the bucket. Of course all such water was liable to contamination, depending on the health of the community, its waste disposal practices and the personal hygiene of the water carriers and water users.

Finding improved methods to distribute water was the first step in improving water supplies for urban residents. Water pipes and, later, water pumps provided the solution. The first recorded use of water pipes in North America ocurred in 1652 when wooden pipes and conduits in Boston were used to carry water from wells to storage tanks, but people still had to fetch their water from the storage tanks. Almost one hundred years later, in 1746, Schaefferstown, Pennsylvania was the first community in North America with water supplied by pipes to all the residents. By 1800 there were only 16 public water supplies in the USA, and one in Montreal, perhaps the first water supply in Canada (discussed hereafter). By 1860 there were 136 public water supplies in the USA and 10 in Canada.

The early water distribution systems in Canada were prompted by the need to fight fires as much as to supply drinking water since major blazes in towns, which consisted mostly of wooden buildings, were a constant problem.

Various processes of water treatment, or "water conditioning" as it was earlier referred to, developed gradually. The ancients knew that visible impurities would settle out of turbid water if the water were allowed to stand quietly. This is the basis for the process of sedimentation, which can be accelerated by the addition of chemicals to clarify the water. Sedimentation basins were developed for early European waterworks but Canada's young cities were located on lakes or rivers with relatively clear water so the early distribution systems in Canada did not have treatment plants.

The process of water filtration for public supplies to remove more impurities than could be eliminated by sedimentation also originated in Europe. Filtration plants were built in Paisley, Scotland in 1804; in Paris in 1806; and in London in 1829. The first filtration plant in North America began operating at Poughkeepsie, New York in 1871. Two Canadian towns on Lake Ontario had some limited success in improving water quality through filtration cribs: Kingston in 1849 and Hamilton in 1859. The first treatment plant reported for Canada was the Jinks Filter in Fredericton in 1891.

Canadian cities were ravaged by deadly epidemics of cholera and typhoid throughout the 19th century and in the early part of the 20th century. The major breakthrough against these waterborne diseases occured when chlorination became available as a process for disinfecting water. The first permanent plant to disinfect water by cholorination was in Middlekerke in Belgium in 1902.This process was rapidly adapted after its first major use in North America in Jersey City, New Jersey in 1908.

Sedimentation and filtration are treatment processes which remove particulate matter and the microbes attached thereto but these processes do not make water free of disease. Disinfection of the water is required to kill pathogens. Many Canadian communities, including Victoria, Greater Vancouver, Winnipeg and Saint John, New Brunswick, still rely on water supplies whose only treatment is disinfection by chlorination.

The chronological developments in the water supplies for three major cities serve to illustrate progress in providing drinking water to Canadians. Montreal's first water supply was built by a private company in 1800, using wooden mains to distribute water originating in the Cote des Neiges pond. Between 1819 and 1845 the wooden mains were replaced by cast iron ones and in 1845 the system was placed under public ownership. A major fire in 1852 destroyed the installations. A new system, operational from 1856, changed the source to the St. Lawrence River. There was no treatment until chlorination was begun in 1910, after repeated typhoid epidemics. Filtration had been proposed as early as 1876 but the first filtration plant began operating in 1918.

Toronto got its first public water supply in 1841 when a private company pumped water from Lake Ontario and distributed it through wooden pipes. By 1856 only 11% of houses in Toronto were using this water system. The city took over in 1873 and built a new system, including a filtration plant in Toronto Island. Chlorination was introduced in 1910.

Ottawa's early residents got their water from water carriers, licensed by City Hall from 1866, who transported water in wooded barrels or carts for sale around the city. Although Parliament had its own private water supply from 1860, water carriers anxious to protect their jobs resisted all efforts to install a distribution system until 1872, when council finally decided to install a piped network, hoping to prevent a major fire such as the one which had razed Chicago in the previous year. The pumping and distribution system began operating in 1874 but the intake in the Ottawa River was downstream of inhabited areas draining into the river, making the network an effective distributor of waterborne diseases. The intake was moved further upstream in 1890 but the city continued to suffer frequent typhoid epidemics. Some 105 typhoid deaths were reported between 1905 and 1910. The 1912 typhoid epidemic resulted in more than 1300 cases and 84 deaths and led to chlorination of Ottawa's water supply from 1913. The intake was moved further upstream in 1915 and the first filtration plant began operating in 1932.

Water quality in existing systems improved considerably in the early part of the 20th century as treatment systems, particularly disinfection, improved. The result was a sharp drop in the incidence of water related diseases. Public health improved accordingly. Deaths from typhoid in

Toronto, for example, were 44.2 per 100,000 population in 1910 but only 0.9 per 100,000 eight years later. In the same period the infant mortality rate was cut by more than half, from 139.2 deaths were 1000 live births in 1910 to 60.3 in 1928.

Effective disinfection practices destroy a range of microbiological organisms as well as more commonly understood pathogens in Canadian water supplies. Legionnaire's disease, for example (named after the 1976 outbreak affecting American Legion members in Philadelphia) has been shown to be caused by bacteria which proliferate in water systems in buildings. Researchers have already located the Legionella organism at several locations[8/] and several hundred cases have been reported in total across Canada, including one major outbreak. Two hundred cases of the potentially fatal disease had been reported at a Los Angeles hospital between 1977 and 1980 but that problem was subsequently solved by continuous intensive chlorination of the water supply[9/].

Another major cause of improvements in drinking water quality during the 20th century has been the increasing emphasis on pollution control and wastewater disposal. Communities have worked hard to improve sewer systems and wastewater treatment plants, with the result that water quality in the receiving bodies, which are often used as water supply sources for other communities, has improved considerably in most parts of the country. However the installation of wastewater treatment facilities has invariably lagged the construction of water supply plants. The best available statistics, discussed further in Section 2.4, indicate that almost half of the population across Canada is not yet served by wastewater treatment plants.

Waterborne diseases seem to have reached relatively low levels in Canada in recent years but the available data may be misleading. Health and Welfare Canada publish an annual summary of reported morbidity due to food and water-related diseases. The most recent summary, for 1978, states that no waterborne diseases were reported for that year (compared, for example, to 9 reported incidents affecting 1,476 people in 1976). These statistics are somewhat unrealistic, reflecting the weakness of the system for reporting such diseases. Knowledgeable public health officials believe we need a more reliable system for reporting waterborne diseases since many local incidents are known to not be included in the national reporting system.

In the United States, 392 outbreaks involving almost 86,000 cases of waterborne disease were reported between 1971 and 1982, or an average of some 7,000 cases per year. The Director of the Criteria and Standards Division of the USEPA office of Drinking Water notes that from three to five times the number of cases actually reported were not recognized and reported, according to a pilot study.[10/] Unreported diseases include acute gastro-enteritis, giardiasis, shigellosis, hepatitis-A, typhoid and salmonellosis. Canada, with a population roughly 10% of the USA, would therefore be expected to experience upwards of 2,000 cases of waterborne diseases annually if the incidence were the same as in the USA and if all cases were actually reported. It is unlikely, however, that many fatalities are occurring due to waterborne infectious diseases. The point is that we simply do not have the data to state confidently the number of people who became infected because of water quality problems.

The foregoing discussion deals with the microbiological quality of water and related diseases, since these problems are known to have been responsible for the deaths of many thousands of Canadians, particularly in earlier periods. Waterborne diseases continue to threaten Canadian health. The Legionella bacteria, discovered within the past ten years, has already been discussed. Giardiasis is emerging as a major waterborne disease in western Canada. There have been outbreaks of viral diarrhoea (recent example in Drumheller, Alberta) and occasional outbreaks of typhoid. Such waterborne diseases are always a threat, requiring consistently high standards of system operation and continuous vigilance in order to prevent such problems.

Another species of concern, however, relates to the chemicals found in water and the possible hazards to public health. In its natural state water contains inorganic components and organic compounds which reflect the materials with which water has been in contact. Water, an excellent solvent, washes the entire surface of the earth. Then it flows downhill through streams and rivers to our lakes, which act as a sink. (The ultimate sink, the ocean, is of less interest because we do not use saline water as a source of drinking water). The types and quantities of impurities which are accumulating in our water sources, including groundwater, are increasing as a consequence of our economic activities.

Scientists have increasingly sophisticated tools and methodologies for analyzing water to detect contaminants. Substances can be found now, in minute concentrations (parts per million, per billion, per trillion or even per quadrillion), which were not possible to detect in earlier times. The powerful combination of a gas chromotograph with a mass spectrometer and data processing equipment has, within the past 20 years, revolutionized knowledge of micro-contaminants in water.

The discovery of increasing numbers of chemicals (some natural and some man-made), at very low concentrations, poses questions about their impact on public health.

Chlorination practices provide an example of the health questions posed by our enhanced analytical ability. About ten years ago it was discovered that a class of organic compounds called trihalomethanes is formed when free chlorine is used to disinfect water at treatment plants. Laboratory experiments on animals indicate that these compounds may present a carcinogenic risk[11]. Scientists and engineers face the dilemma of determining whether or not to continue to disinfect water with a proven technology, chlorination, which has definite advantages as well as possible negative inpacts, of an indeterminate magnitude, on human health.

Research scientists can demonstrate that some of the known contaminants in water sources can be a risk to human health just as some, such as fluorine, can be beneficial in the proper concentration. The health impacts of the entire spectrum of contaminants are unknown, and probably never can be known with any certainty, because of the formidable problems of determining causal relationships. We are at a very early stage in understanding the health implications of trace quantities of chemicals in our water supplies.

2.3 Legislative and Regulatory Framework for Water Supply

The legislative and regulatory framework concerning the safety of drinking water in Canada is complex. There are 15 major water-related pieces of federal legislation and 82 pieces of provincial legislation[12].

As a general rule drinking water matters fall mainly under the responsibility of provincial governments, although there appears to be plenty of scope for the federal government activity in related areas. However, in practice if not in theory, drinking water activities are largely concentrated in the local government arena. Thus, while most legal arguments have concentrated on federal-provincial jurisdictional questions, the overwhelming number of practical drinking water problems are manifested at the local government level, since this is the point from which the service is rendered to the public.

2.3.1 Federal Involvement

The Constitution Act, 1982, does not provide any clear indication as to which level of government should have jurisdiction over drinking water matters although, on balance, there appears to be more direct responsibilities conferred on the provinces than to the federal government for the management of water resources. At best, one can argue that the two levels of government have overlapping jurisdiction over the quality of Canada's water resources.

In essence, the federal government derives its authority to legislate in the area of water and water quality as a result of its responsibilities for navigation and shipping (S.91[10]) and for sea coast and inland fisheries (S.91[12]). In the wider context, the federal government also has criminal law powers (S.91[27]) which would include the right to prosecute individuals and corporate entities for causing bodily harm to those affected by water contaminants, etc. Finally, the federal government also has at its disposal the general powers to act and to pass legislation for the "peace, order and good government of Canada". This latter, rather sweeping provision, has been used in the past by the federal government to move into new areas, generally with national dimensions, when there was a strong enough political will to withstand the pressures from the provinces to back off. Thus, while the "peace, order and good government" option is an attractive one from the standpoint of widening the scope of federal government operations, its use exacts a heavy price in terms of harmonious federal-provincial government relations.

In recognition of the overlapping jurisdiction, the previous Liberal government appears to have steered a course away from direct intervention in water and water related legislation. While some federal water legislation exists, which will be described briefly below, the single most important federal activity in the drinking water area has been the production of drinking water guidelines (1968 and 1978 versions - see Section 3.1.2). These guidelines, developed cooperatively with the provinces, serve only as recommended levels of drinking water quality and, as a consequence, do not have any punitive effects if the limits are exceeded.

The federal laws which indirectly touch on drinking water include the Fisheries Act which is designed to ensure that lakes and rivers are clear of pollution in order to preserve fish stocks for commercial and sport fishermen. The Act gives fishermen the right to sue for compensation if their livelihoods are threatened by polluted waters.

The Canada Water Act is designed to coordinate the activities of the provinces in regulating water management on a national basis. To this end, the federal government can enter into agreements with the provinces to provide for comprehensive water resource management projects related to waters which have some significant national interest. In general terms, the objectives for these agreements are:

a) to set in place a mechanism that will permit the parties of the agreement to acquire water quality information on a joint long-term basis;
b) improve the scientific integrity of water quality monitoring networks;
c) combine water quality information into a common data base; and
d) disseminate current information regarding water quality.

As well, the federal government administers an Environmental Contaminants Act, the purpose of which is to "protect human health and the environment from substances that contaminate the environment". According to the Canadian Environmental Law Association, the act is designed to be residual legislation and "only to be used if the environmental problem cannot be addressed by other provincial and federal laws"13/. The Pest Control Products Act deals with water issues only when pesticides or their derivatives are judged to have a potentially negative effect on water supply, especially groundwater.

While the federal government has not yet made any explicit moves to introduce federal drinking water legislation, there have been consistent indications that action in this regard may soon be initiated by the Minister of Health and Welfare. At the 1984 National Conference on Critical Issues in Drinking Water Quality the Deputy Minister of the Department of Health and Welfare, speaking in place of the then Minister, alluded to the possibility of federal legislation in this area.

There is some evidence that the new government in Ottawa will proceed with legislation related to drinking water. A private member's bill was introduced in the House of Commons in 1983 and again on November 29, 1984 (Bill C-212) by Neil Young (New Democratic Party, Beaches, Ontario). In this bill, entitled "An Act to Protect and Enhance the Quality of Drinking Water in Canada", Mr. Young proposes that the federal government begin a consultative process which will culminate in the setting of regulations to establish maximum permissable levels for contaminants and other substances in drinking water. The resulting regulations would apply to both public and private water systems. As well, the Bill requires the operators of public water systems to monitor water quality on a regular basis and to notify consumers and the Minister of the Environment of the results of this monitoring efforts. Furthermore, the Bill makes it an offence for the operator of a public water system to provide water which contravenes the regulations or fails to comply with the monitoring requirements. Water

users are allowed to sue the water suppliers for damages resulting from water in contravention of regulations. Finally, the Minister is given the powers to conduct research into drinking water matters and to set up a Water Review Board and a Water Advisory Council to provide advice to the Minister of the Environment by holding hearings and reviewing the status of current drinking water and related research.[14]/

The private member's bill was talked out, with no action taken on the member's motion of January 21, 1985 to refer it to the Standing Committee on Fisheries and Forestry.

In responding to the second reading of the proposed legislation in the House of Commons debates, Mr. Jean-Luc Joncas, on behalf of the Minister of the Environment provided the most compelling evidence yet that the present government has plans to introduce its own legislation. He stated that "the Minister of National Health and Welfare has started talks with the provincial governments with a view to formulating proposals and tabling in the House a Bill concerning the quality of drinking water in Canada. The purpose of the Bill will be to set objectives for ensuring the quality of drinking water". He went on further to note that "I am convinced that my colleague, the Honourable Minister of National Health and Welfare, will make good use of Bill C-212 and the results of the Pearse Committee investigation when preparing recommendations on the quality of drinking water". Mr. Joncas concluded his remarks by recommending "that Bill C-212 be withdrawn until my colleague, the Honourable Minister of National Health and Welfare, can introduce his own bill which will allow the House to review indepth federal concerns related to drinking water".[15]/

2.3.2 Provincial Involvement

While a law professor at the University of Toronto, the former Chief Justice of the Supreme Court of Canada, Bora Laskin, stated:

> "It is a safe generalization that the regulation and distribution of water resources in a province for domestic consumption or industrial purposes are within exclusive provincial competence. While some qualification has to be made, as for example, in respect of public rights of navigation or in respect of interference with federal property or competent federal law, it yet remains true that appropriation of water for private use is subject to definition of provincial law"[16]/.

Thus, it can be said that the constitutional structures give sweeping powers to the provinces in most of the matters related to water. This situation arises from the provinces' ownership of the public lands combined with heads of legislative power related to those lands, property and civil rights in the province (S.92(13)) and all matters of a local and private nature (S.92(16)) and powers of management and sale of the public lands belonging to the province (S.92(5)).

Our research confirms that virtually every province has, at the very least, some environmental legislation in place which attempts to regulate the quality and character of its environment. Only the province of Quebec has placed within its own legislative competence enforceable rules which govern the quality of drinking water.

Quebec's Environmental Quality Act of 1984 stipulates that whoever operates a water facility must make regular inspections of the drinking water quality and of the outflow water according to the regulations established by the Minister of Environment. Under the Act the Minister can also promulgate regulations regarding water quality norms and determine contaminant levels for each region or territory in the province.

One notable outcome of this legislation is the additional expense and administrative costs which have been imposed on the municipalities in order for them to comply with the legislation. In contrast to the situation in the United States (discussed in Chapter 4), the Quebec law stipulates that municipalities must conduct water quality tests at their own expense.

In the remaining provinces we are faced with a wide array of legislative and persuasive methods of controlling drinking water quality. Many provinces have listed guidelines or suggested quality standards for water supply but these are unenforceable. In consequence Canadian citizens, in all provinces except Quebec, have no legal resources against the water supply utilities if they provide lower quality water than specified in the national guidelines.

Provinces such as Ontario, however give local health officials the power under public health legislation to shut down public water supplies if they detect the presence of communicable disease organisms in the water.

In New Brunswick, for instance, the government has had a Clean Environment Act in effect since 1978. In this piece of legislation the Minister of Environment has the mandate to limit or control the rate of discharging or depositing of any contaminant or waste into or upon the environment. As well, the Minister can also stop, alter or force a clean-up of any substance which had deleterious effect on the environment. Specifically, the Minister can also, upon reasonable and probable grounds, issue a stop order directed to any person responsible for the source of any contaminant jeopardizing a waterworks. This can only be acted upon if there is any immediate danger to human life, the health of any person, fish, animal or plant life, or to property. The province is very clear that all water found within the confines of the province is vested in the Crown in right of the province.

In Alberta, under the Clean Water Act, the Minister of Environment can make regulations prescribing water contaminants and the maximum permissible concentration in surface water of any water contaminant. As in New Brunswick the Minister must also approve the construction of waterworks and sewer works and also provide a license in respect to the operation of the water facility.

The Ontario Water Resources Act allows the Minister of the Environment to make regulations specifying standards of quality for potable and other water supplies. However, no such enforceable regulations have been promulgated. Instead the government relies on non-enforceable water quality guidelines, covering less than thirty substances, which are published in "The Blue Book" outlining the Minister of the Environment's water management program. The Environmental Protection Act gives the Ministry of the Environment themandate to investigate all problems of

pollution, including water issues. As well, the Act stipulates that no person shall add any contaminant into the natural environment in an amount in excess of the levels set out in the prescribed regulations. In the case of sewage, the Minister can enter directly into an agreement with the municipalities for the provision of sewage treatment.

2.4 Water Supply and Wastewater Systems in Canada

There were 25 million people in Canada in 1984, distributed in the provinces and two territories as shown in Table 2.1. The largest province, Ontario, contained more than a third of the national population while the Yukon Territory had less than 0.1% of the total.

The Canadian population is highly urbanized, with most people living in cities and towns. Data in Table 2.2 indicate that three-quarters of the urban population live in centres with more than 10,000 inhabitants.

The data in Tables 2.2 to 2.6 are provided on the basis of the National Inventory of Municipal Waterworks and Wastewater Systems in Canada, known as MUNDAT. This inventory was created following a joint project initiated in 1974 between the federal and provincial governments and the Federation of Associations on the Canadian Environment (FACE). Data for MUNDAT is collected and updated by the provinces. The federal government (Environment Canada) stores this information in the national data base.

Data in the MUNDAT system are the best available but have imperfections. For example, the population reported surveyed in Quebec in Tables 2.4 and 2.5 is in excess of the total provincial population (Table 2.1). Nevertheless these data are the best available to permit an overview of the water supply and wastewater sector.

Whereas rural residents and people in very small centres generally provide their own water supplies, residents in larger urban centres rely primarily on piped water supplies which serve the entire community. Both the number of water supply systems in Canada and the population served by these systems approximately tripled between 1940 and 1984, as indicated in Table 2.3.

A total of 2,548 communities, containing 97% of the population surveyed and some 84% of the total Canadian population, were provided with piped water supplies in 1983, according to MUNDAT data compiled by Environment Canada and summarized in Tables 2.4 and 2.5. Some 1,800 of these communities had water treatment facilities, serving 83% of the population surveyed. The water supply systems, including the treatment plants, are predominantly owned and operated by the municipalities, according to Table 2.6, but provincial governments also operate some plants.

Smaller percentages are served by sewers and wastewater treatment plants according to Tables 2.4 and 2.5. Some suburban and rural residents have on-site disposal systems (usually septic tanks). These figures also

Table 2.1

CANADIAN POPULATION		
Province or Territory	Population	% of Total
Newfoundland	578,900	2.3
Prince Edward Island	125,000	0.5
Nova Scotia	868,100	3.5
New Brunswick	712,300	2.8
Quebec	6,540,100	26.5
Ontario	8,916,800	35.5
Manitoba	1,054,400	4.2
Saskatchewan	1,003,300	4.0
Alberta	2,349,100	9.2
British Columbia	2,863,200	11.2
Yukon Territory	21,700	0.1
Northwest Territories	49,300	0.2
Total	25,082,200	100.0

Source: Estimate by Statistics Canada of population in April, 1984 based on 1981 census.

Table 2.2

DISTRIBUTION OF CANADA'S URBAN POPULATION					
Population	Communities		Population		
Size Group	Number	% of Total	Number	% of Total	Cummulative %
Less than 1,001	1,557	47.80	828,909	3.88	3.88
1,001- 2,500	841	25.81	1,306,255	6.11	9.99
2,501- 5,000	353	10.83	1,277,429	5.98	15.97
5,001- 10,000	223	6.84	1,586,918	7.42	23.39
10,001- 30,000	169	5.20	2,823,925	13.21	36.60
30,001- 100,000	85	2.61	4,597,714	21.51	58.11
100,001- 250,000	17	0.52	2,470,908	11.56	69.67
250,001- 500,000	7	0.21	2,243,609	10.50	80.17
500,001- 1,000,000	5	0.15	2,957,023	13.84	94.01
More than 1,000,001	1	0.03	1,280,000	5.99	100.00
Total	3,258	100.00	21,372,690	100.00	100.00

Source: Data provided by provincial governments and compiled in January, 1985 by Environmental Protection Service of Environment Canada, Ottawa.

DEVELOPMENT OF PUBLIC WATER SUPPLY SYSTEMS SINCE 1940

Provinces	1940		1952		1962		1972		1980		1984	
	Number of Systems	Population Served (thousands)	Number of Systems	Population Served (thousands)	Number of Systems	Population Served (thousands)	Number of Systems	Population Served (thousands)	Number of Communities	Population Served (thousands)	Number of Communities	Population Served (thousands)
British Columbia	43	672	73	913	76	1,221	84	1,400	109	1,963	110	2,114
Alberta	23	244	39	377	58	629	71	1,183	104	1,593	108	1,813
Saskatchewan	32	185	23	225	36	359	55	450	61	528	64	562
Manitoba	18	348	23	407	44	484	107	550	40	757	40	758
Ontario	239	2,453	320	3,116	282	3,910	294	6,219	341	7,481	352	7,552
Québec	144	2,197	230	2,977	267	3,000	289	3,556	673	6,110	675	6,115
New Brunswick	26	158	17	172	26	189	26	271	46	358	50	356
Nova Scotia	21	189	26	219	28	243	36	418	48	462	48	462
Prince Edward Island	2	19	2	24	3	26	3	32	5	44	5	44
Newfoundland	—	—	5	72	18	146	31	216	82	394	85	380
Total	548	6,465	758	8,502	838	10,207	996	14,295	1,509	19,690	1,573	20,156

Notes: 1. Data for 1940, 1952, 1962 and 1972 from Canada Water Year Book, 1975 by Environment Canada (Table 13). 1940 data refer to municipalities over 500 persons whereas 1952-72 data refer to municipalities over 1,000 persons.

2. Data for 1980 and 1984 from MINDAT survey compiled by Environment Canada, using data supplied by provinces and territories. These data refer to water distribution networks serving communities larger than 1,000 people, in order to be consistent with data for 1952-72. Data which include smaller communities are provided in Table 2.4.

3. In 1980 there were also 6 water supply systems serving 21,200 people in the Yukon and 35 systems serving 37,700 people in the Northwest Territories. Comparable data for these territories is not available for earlier years.

CANADA : WATER SUPPLY AND WASTEWATER SYSTEMS: EXTENT OF SERVICE IN EACH PROVINCE AND TERRITORY

	PROVINCE OR TERRITORY												
	Newfoundland	Prince Edward Island	Nova Scotia	New Brunswick	Québec	Ontario	Manitoba	Saskatchewan	Alberta	British Columbia	Yukon Territory	Northwest Territories	TOTAL
No. of communities surveyed	322	23	104	98	1,479	434	271	140	205	134	8	50	3,258
Total population surveyed	497,018	57,587	536,604	409,900	6,685,434	7,641,607	839,158	611,072	1,852,715	2,175,754	21,888	43,953	21,372,690
WATER													
Number of communities with distribution network	229	6	92	64	1,056	412	185	140	201	131	6	36	2,548
Percentage of surveyed population served by distribution network	91.4%	77.2%	89.9%	89.1%	95.1%	99.3%	96.7%	100.0%	100.0%	97.8%	97.0%	86.1%	97.1%
No of communities with water treatment	172	1	64	22	556	405	137	135	180	96	6	36	1,800
Percentage of surveyed population served by water treatment	72.3%	36.5%	81.5%	64.8%	80.2%	90.5%	93.5%	98.0%	95.6%	54.0%	98.0%	86.1%	93.1%
WASTEWATER													
No. of communities with sewers	146	23	100	85	905	341	149	140	200	119	8	48	2,164
Percentage of surveyed population served by sewers	60.8%	100%	33.3%	91.8%	91.9%	96.1%	94.9%	99.0%	99.3%	77.5%	38.0%	91.6%	95.3%
No. of communities with sewage treatment plants	54	23	78	90	246	341	145	140	200	111	7	17	1,442
Percentage of surveyed population served by sewage treatment	12.9%	36.4%	21.4%	60.7%	6.3%	83.5%	94.7%	99.0%	99.3%	77.5%	86.3%	52.5%	57.3%

Source: Data provided by provincial governments and compiled in January, 1985 by Environmental Protection Service of Environment Canada, Ottawa.

CANADA : WATER SUPPLY AND WASTEWATER SYSTEMS: EXTENT OF SERVICE BY POPULATION SIZE GROUPS

	POPULATION SIZE GROUPS										
	Less than 1,000	1,000 - 2,500	2,500 - 5,000	5,000 - 10,000	10,001 - 30,000	30,001 - 100,000	100,001 - 250,000	250,001 - 500,000	500,001 - 1,000,000	Greater than 1,000,001	TOTAL
No. of communities surveyed	1,557	841	353	223	169	85	17	7	5	1	3,259
Total population surveyed	828,909	1,306,255	1,277,429	1,586,918	2,823,925	4,597,714	2,470,908	2,243,699	2,957,023	1,280,000	21,372,696
POTABLE WATER											
No. of communities with distribution network	999	716	334	215	169	84	17	7	5	1	2,547
Percentage of surveyed population served by distribution network	67.2%	86.7%	94.9%	96.1%	100%	99.0%	100%	100%	100%	100%	97.1%
No. of communities with water treatment	599	471	267	194	159	81	17	6	5	1	1,800
Percentage of surveyed population served by water treatment	33.6%	47.9%	66.9%	75.9%	79.6%	89.2%	96.7%	81.5%	100%	100%	83.1%
WASTEWATER											
No. of communities with sewers	739	627	314	199	164	85	17	7	5	1	2,157
Percentage of surveyed population served by sewers	34.5%	56.6%	70.7%	73.0%	78.2%	86.5%	91.9%	98.5%	100%	100%	84.3%
No. of communities with sewage treatment plants	522	397	194	134	112	56	14	7	5	1	1,442
Pecentage of surveyed population served by sewage treatment	27.8%	16.1%	45.4%	46.8%	45.1%	48.8%	66.0%	92.0%	100%	0.0%	57.3%

Source: Data provided by provincial governments and compiled in January, 1985 by Environmental Protection Service of Environment Canada, Ottawa.

WATER SUPPLY TREATMENT PLANTS BY PROVINCE/TERRITORY

Province or Territory	Municipal		Provincial		Private		Total	
	Number of Plants	Population Served (thousands)	Number of Plants	Population Served (thousands)	Number of Plants	Population Served (thousands)	Number of Plants	Population Served (thousands)
Newfoundland	181	487	1	9	5	21	187	517
Prince Edward Island	1	21	—	—	—	—	1	21
Nova Scotia	52	575	2	2	2	1	56	578
New Brunswick	21	792	1	5	—	—	22	797
Québec	392	5,377	3	7	28	44	423	5,428
Ontario	201	3,383	89	1,232	—	—	290	4,615
Manitoba	89	734	64	30	4	3	157	767
Saskatchewan	140	776	—	—	—	—	140	776
Alberta	166	1,827	2	3	—	—	168	1,830
British Columbia	76	782	—	—	—	—	76	782
Yukon Territory	7	19	—	—	—	—	7	19
Northwest Territories	5	14	42	21	1	3	48	38
Total	1,331	14,787	204	1,309	40	72	1,575	16,168

Source: data provided to MUNDAT by provincial governments and compiled in January, 1985 by Environmental Protection Service of Environment Canada.

reflect the fact that wastewater systems, particularly treatment plants, often have a lower priority for communities than water supply systems. The data for Quebec*/, for example, indicate that water supply treatment plants serve 80% of the population surveyed while sewage treatment plantsserved only 6%. In Newfoundland, where most communities are along the coast, only 13% of the population is served by sewage treatment plants.

2.4.1 Water Supplies in Indian and Northern Communities

There are an estimated 330,000 Indians in Canada, of whom approximately 70%, or more than 220,000 people in 1984, live on reserves. The standards of water supply and sanitation on the reserves in some parts of the country are much lower than in many developing countries. The majority of Indian reserves in northern Alberta are without proper water supply and sewage disposal facilities. In Saskatchewan and Manitoba, where Indians represent between 4% and 5% of the provincial population, less than 15% of the on-reserve houses had running water in 1977 and less than 10% of the houses had sewers or septic tanks. The situation was better in other provinces but only 50% of the on-reserve Indian houses across Canada had running water. These figures indicate that more than 100,000 Canadian Indians live in houses without running water[17]/.

The Department of Indian and Northern Affairs is responsible for municipal services on Indian reserves. It is the Department's goal that Indian communities should have services that are comparable to non-Indian communities in the same geograhic areas and substantial resources are committed to providing such services. It should also be pointed out that the socio-economic and geographical conditions in most Indian communities make the provision of water supply services, particularly piped water supplies, very difficult and expensive. Many families, for example, leave their homes unattended for long periods while they go hunting or trapping. Some communities, according to Department officials, seem to lack and understanding of hygienic priorities and fail to protect local water sources, such as wells, from contamination[18]/.

Canadian representatives helped to plan the International Drinking Water Supply and Sanitation Decade and endorsed it at the United Nations in 1980. Most developing countries, many assisted by Canada, have developed action plans to meet the goals of the Decade by 1990. However there does not appear to be a definite program to ensure that all people within Canada, particularly in the Indian and northern communities where services are least developed, will have access to reliable supplies of safe drinking water by 1990.

*/ MUNDAT data for Quebec date back to 1979-80. Quebec has recently given priority to pollution control programs and is currently engaged in planning and constructing many sewage treatment plants. It is estimated by the Quebec Ministry of the Environment that some 9% of the total population or 12% of those on sewer systems were served by sewage treatment plants in 1984.

2.5 The Canadian Water Supply and Wastewater Industry

Individual families and very small communities in the rural areas provide their own water supplies privately. Most Canadians obtain their water supplies from public water systems, the vast majority of which are owned and operated by local municipalities. The industry is highly decentralized because the local water supply systems (unlike other utilities such as power, telephone and gas) are physically independent from one another. Some coordination is provided by the provincial governments which assist local authorities.

The tasks in the water supply industry can be separated into three groups:

a) research, planning and design;
b) equipment manufacture and facility construction; and
c) system operation and maintenance.

Because of the decentralized nature of the industry, statistical analysis of the number and type of people employed are not available. It is clear that most of the workers are involved in operation and maintenance. It has been estimated that some 40,000 people are involved in operating and maintaining water supply and wastewater systems across Canada[20/], comprising:

- 20,000 in water supply operations;
- 15,000 in wastewater operations;
- 5,000 in support positions (provincial and federal governments and private sector).

Roughly $ 2,000 million is spent annually on construction of new facilities for water supply and wastewater systems according to Statistics Canada data in Table 2.7. Such investment generates considerable employment in the private and public sectors throughout the country but we are not aware of any study which quantifies the resulting employment.

Table 2.7

TOTAL VALUE OF CONSTRUCTION WORK ON WATER SUPPLY AND SEWERAGE SYSTEMS IN CANADA, 1973-1983

Year	Water Supply			Sewage systems, treatment plants and connections	Total (Current Prices)	Total in constant prices of 1983 $ million
	Water mains, hydrants and services	Water pumping stations, treatment plants and tanks	Sub-total			
1973	199,166	45,498	244,664	390,092	634,756	1,626
1974	299,405	60,291	359,696	509,779	869,475	1,932
1975	311,392	92,138	403,530	584,093	987,623	1,975
1976	380,317	129,215	509,532	658,978	1,168,510	2,125
1977	439,023	148,862	587,885	725,843	1,313,728	2,227
1978	515,948	245,191	761,139	615,360	1,376,499	2,185
1979	527,852	271,807	799,659	673,461	1,473,120	2,135
1980	542,779	285,455	828,234	663,970	1,492,204	1,938
1981	606,480	293,237	899,717	664,530	1,564,247	1,862
1982	683,578	335,612	1,019,190	733,598	1,752,788	1,885
1983	731,528	338,254	1,069,782	836,663	1,906,445	1,906

Source: Statistics Canada, "Construction In Canada", Catalogue No. 64-201.
Notes: 1. Data include repairs as well as new construction.
2. Reported costs are stated in current prices. Last column shows values in constant prices of 1983, based on index used by Energy, Mines and Resources Canada.

One method of estimating the approximate employment impact is to compare it to the electric power industry in Canada, where recent analysis indicated that some 60,000 people (5,000 consultants; 35,000 manufacturers; and 20,000 constructors) were associated with capital expenditures of between $ 8 billion and $ 9 billion yearly in the recent past21/, or roughly 6,700 people employed annually per billion dollars of capital expenditure. Water and wastewater systems would be expected to be more labour intensive (mostly underground piping) so $ 2 billion per year of construction in this sector might account for some 15,000 jobs.

In summary, Canada's water supply and wastewater industry is estimated to employ a total of between 50,000 and 60,000 people in all phases of planning, construction and operation. This is necessarily a very crude estimate but nevertheless provides a useful indication of the scale of the industry.

2.5.1 Industry Associations

The border between Canada and the United States is little noticed by practitioners in the water supply and wastewater industry or their principal industrial associations, which have North American rather than national orientations. They are:

a) American Water Works Association (AWWA), headquartered in Denver, Colorado and serving up to 37,000 members in the water supply industry through 40 regional sections in North America. AWWA and its sister organization, AWWA Research Foundation, provide information on the drinking water industry through three national conferences and exhibitions; nine periodicals; 98 standards; 22 manuals of practice; numerous proceedings, texts, handbooks, bibliographies, and reference books; dozens of brochures and pamphlets; library services, including computerized data base, WATERNET; training seminars and packages; school education materials; public affairs materials; policy statements; and public testimony.

b) Water Pollution Control Federation (WPCF), headquartered in Washington, DC and serving the wastewater industry through 60 local associations. WPCF members, over 30,000 in the U.S.A., Canada and abroad, work with the Federation for the development and dissemination of technical information concerning the nature, collection, treatment and disposal of domestic and industrial wastewaters.

The Canadian section of AWWA was founded in 1916 and held annual conferences for 51 years, from 1920 to 1970. In that year AWWA activities in Canada were reorganized into regional sections.

Water supply and wastewater specialists in Canada now organized in six associations in five regions, as follows:

Maritimes: Atlantic Canada section of AWWA;
Quebec: Association Québécoise des Techniques de l'Eau (AQTE);
Ontario: Ontario section of AWWA; and
Pollution Control Association of Ontario (PCAO);
Prairies: Western Canada Water and Sewage Conference;
British Columbia: BC Water and Waste Association.

All Canadian regional associations except PCAO are sections of AWWA. All regional associations except the Ontario and Atlantic Canada sections of AWWA are also local associations of WPCF.

In 1971 these six regional associations created a national organization, the Federation of Associations on the Canadian Environment (FACE) whose total membership, through its constituent organizations, is over 5,000 people.

The principal activities of FACE have included:

a) Planning the MUNDAT system (National Inventory of Municipal Waterworks and Wastewater Systems in Canada), initiated in 1974 and published by Environment Canada in 1975, 1977 and 1981.

b) Cooperating with Environment Canada in preparing training programs for wastewater treatment plant operators.

c) Production of training materials for the National Water Works Operators Training Program under a program funded by Health and Welfare Canada and seven provinces.

d) Investigating the feasibility of recording drinking water quality data in a central information system for Health and Welfare Canada[22/].

e) Organizing the February, 1984 conference on Critical Issues in Drinking Water Quality, supported by Health and Welfare Canada.

f) Analyzing the water pollution control industry in Canada for Environment Canada[23/].

g) Making submissions and presentations on behalf of Canada's water supply and wastewater industry, including one to this Inquiry.

Although the water supply and wastewater industry in Canada is large in terms of employment and annual expenditures, and provides services which are absolutely vital, this industry is nevertheless quite fragmented and very weakly organized. Accordingly the industry is able to exert very little influence, collectively, on provincial and federal government policies and programs.

The weakness stems mainly from the structure of the regional associations and FACE. One problem is that the membership in the six regional organizations consists mainly of individuals, predominantly engineers and technicians, who join voluntarily on a personal basis. Directly related to the question of personal rather than institutional membership in industry associations are the limited financial resources of the regional and national associations. Except for AQTE, the regional associations depend for their revenues primarily on annual dues from the members (typically up to $50/year), of which a large portion is transferred to AWWA or WPCF headquarters*/. This leaves the regional associations with very modest budgets to conduct their affairs. The organizations typically depend upon part-time secretarial staff plus volunteers for all activities, which consist mainly of meetings by various committees and an annual conference. AQTE is different, having a substantial budget (financed by publications and research projects as well as contributions from suppliers and individual members) and a full time, professional staff. AQTE is by far the most active regional association in Canada.

Another limitation facing the Canadian industry is the fact that both AWWA and WPCF are USA-based organizations whose members are mostly USA practioners. The legislative and regulatory environment in the USA is markedly different than in Canada (see further information in Chapter 4) and the government affairs activities of AWWA and WPCF concentrate, naturally, on the USA situation.

FACE, the federation of six Canadian regional organizations, survives financially on a levy of $ 2.00 annually per member plus contracts for research and training activities. FACE has only had full time staff since 1981 (an executive director and his administrative assistant). FACE has provided remarkably good service to the industry on such modest resources but is nevertheless limited as to what it can accomplish.

2.6 Public Opinion

Only very limited information is available regarding public opinion towards water quality or safe drinking water. The best sources of information available for analytical purposes are contained in reports prepared by the major national omnibus survey firms which specialize in public policy matters. Aside from those which are discussed hereafter, there remains a single study presented by Dr. Kristin Shannon of Canadian Trend Report to the National Conference on Critical Issues in Drinking Water Quality held in February, 1984 in Ottawa. This conference, which brought together experts in drinking water from Canada and abroad, was supported financially by the Health and Protection Branch of the Department of Health and Welfare and co-sponsored by FACE, the Canadian Environmental Law Association and Pollution Probe.

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*/ Municipalities, consulting firms and manufacturers can also choose to join AWWA as corporate members, at fees proportional to the scale of this activity, but only a small percentage actually do so. Such fees go mainly to AWWA headquarters.

Dr. Shannon claims in her presentation that water quality "has emerged as the number one issue and symbol of environmental concern in Canada today"24/. She bases this assertion on the fact that in her daily monitoring of issues raised in the printed press using content analysis, over the last three years, environmental health concerns have remained among the top ten (currently 7th) of major concerns to Canadians. Furthermore, it is claimed that somewhere between 5 and 6 percent of the total national news window is devoted to environmental matters and of this amount a little more than 20% of the subject concentrates on water pollution matters. Thus while there appears to be interest on the public's part for environmental concerns, in general, there is only some interest in questions regarding water quality and almost none for the quality of drinking water.

Despite this rather limited coverage of drinking water as a policy concern, Dr. Shannon does find in the data considerable support among the press media for environmental issues. For one, it appears that Canadians have a strong environmental ethic which in practical terms places special emphasis on the health consequences of environmental issues. This concern is especially acute when highly emotive diseases such as cancer are linked with environmental contaminants of any kind. As well, Canadians appear to have trouble understanding the notion of risk and how the negative effects of contaminants can only be measured in terms of probabilities. The press also has this same problem which is often reflected in their interpretation of scientific findings. As a consequence, the public has a strong desire to interpret risk in its simplest state which is whether there is or is not any risk associated with a certain behaviour such as drinking water from a given source.

Coupled with the public's fear of strange sounding names, which often are the complex chemical structure of chemicals and other contaminants found in drinking water, we find that the public although not always conscious of its interest in water quality maintain a strong latent interest in ensuring that problems do not develop. In a way, water quality is one policy area the public prefers not to hear too much about, and when it does, demands immediate and remedial action with a passion and degree that is often surprising.

As a consequence of this situation, Dr. Shannon comments that there is strong wide-ranging support for change even when drinking water problems are identified as being local in nature. As well, she feels that the public has high expectations for government action. In support of strong government action Dr. Shannon feels that there is a widely based array of committed interest groups which are willing to apply pressure for reform. These groups include organized labour, environmentalists, tourist-business associations and consumer organizations. Finally, Dr. Shannon forsees the possible linkage of water problems, waste disposal and drinking water into a single public interest issue.

While the Shannon results are quite forceful in light of the apparent concern Canadians have for their environment, none of the majoromnibus survey firms report such a strong public interest in environmental

matters. The 1984 Goldfarb*/ report does not include environmental issues in its list of the top ten matters of concern to Canadians. Only when pressed do respondents report that acid rain is the most important environmental issue facing Canadians today. Similarly, Decima reports that environmental matters are not one of the public's nine most important issues, at least during the summer of 1984. In fact fewer than 1% of respondents list the environment as the single most important issue of the day.

Centre de Recherche pour Opinion Publique (CROP) in its fourth report of 1984 cites pollution as the most important environmental problem, although it posed the question to its respondents rather than elicited it. Interestingly, in a question regarding the extent to which government or businesses should be blamed for the pollution problem in Canada, 50% of respondents blamed business for pollution problems, down from 64% in 1982. In a subsequent question enquiring about the role government and business are playing in solving the pollution problems, 54% cited government as doing the most while 12% suggest that business was doing the most. These results compare with findings of 46% and 10% recorded in 1982.

Finally, a recent Decima study commissioned by the Department of Health and Welfare provides some further insight into public perceptions of health matters. In this study respondents were asked to indicate the perceived health hazards of four environmental hazards. These hazards were food additives, tap water, air pollution and pesticides. Tap water was not perceived to be a serious health hazard according to the authors of the report, but neither was it seen to be totally without danger. Interestingly, the authors note that messages about deteriorating water quality would heighten public concern and hence stories about Great Lakes pollution might be expected to have some effect on national as well as local perceptions. As well, Quebec respondents perceive a more serious risk from tap water than do other respondents, despite the fact that Quebec is the only province with drinking water legislation.

While there is no obligation for government to act directly in response to public opinion, from a public policy perspective, it usually helps to know the extent and the degree to which the public supports government action in any policy field. Based on these largely circumstantial data there is insufficient evidence, at this time, to suggest that the public is demanding immediate government action.

However, we caution that the latent function of this policy item is extremely high and, as a consequence, could move to the fore of public opinion if some event, such as the discovery of a new contaminant in local drinking water, becomes publicly known. It is in this context that we caution policy makers from underestimating the potentially important role public opinion might play in this area.

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*/ Goldfarb, Decima and CROP reports are sold on a subscription basis to clients. These results have been provided to the authors by subscribers.

3.0 PRESENT ROLES OF THE FEDERAL GOVERNMENT

We decided against reviewing the activities of each provincial government in the water quality area since our interests are centered on federal activities. It was evident from our research that each province handles drinking water in its own way, with no common organizational model.

3.1 Federal Government Activities

The two federal government departments which are most involved in issues pertaining to drinking water quality are Environment Canada and National Health and Welfare. Relevant activities of both are discussed hereafter.

The Department of Indian Affairs and Northern Development has an ongoing interest in water quality, particularly as it affects native peoples (Section 2.4.1). The Prairie Farm Rehabilitation Program (PFRA), now part of Agriculture Canada, has assisted in the construction of municipal water supply and sewer systems in the prairie provinces (Section 3.2.2). The National Research Council, until expenditure cuts in 1984 eliminated this program, had an interest in both hydrology and enviromental quality which was usually manifested in the form of annual conferences and occasional publications of interest to the scientific community.

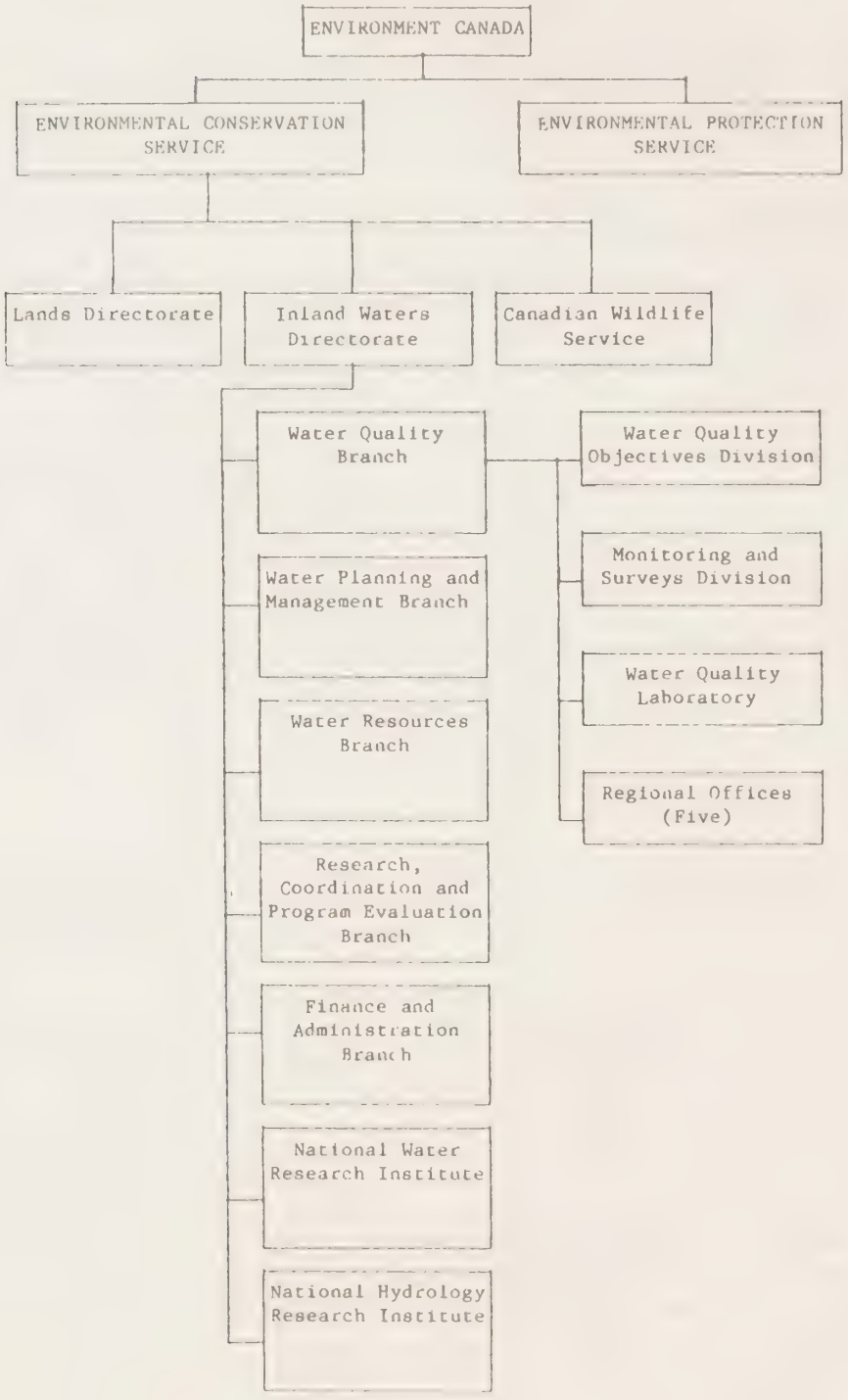
3.1.1 Environment Canada

Environment Canada has a longstanding but peripheral interest in drinking water since most of its water-related activities are part of its efforts to monitor environmental conservation in the larger context of ambient water matters. Within this framework Environment Canada operates four Directorates in the Environmental Conservation Service (see Figure 3.1). Of these four Directorates the Inland Waters Directorate assumes the primary departmental responsibility for raw water quality in its own Water Quality Branch. The purpose of the Branch is to promote the conservation and enhancement of the quality of Canada's inland water resources for the economic and social benefit of Canadians by providing scientific and technical information and advice on water quality. This activity also provides leadership in conserving and sustaining Canada's water resources and related environmental systems. The Branch helps meet the government's responsibilities under the Canada Water Act, the Boundary Waters Treaty Act, and the International River Improvements Act.

The Water Quality Branch is made up of an interdisciplinary team of chemists, biologists, geologists, hydrologists, mathematicians, engineers, meteorologists and technicians, each of whom is involved in various aspects of the water quality monitoring process. The Branch is highly decentralized with its headquarters in the National Capital Region (Hull) and with regional offices in five regions of the country. Among its tasks the Branch is responsible for negotiating water quality monitoring agreements with the provinces; formulating methods of measuring water quality more effectively and efficiently; providing water quality data by analyzing environmental samples which have been collected from stations

FIGURE 3.1

ORGANIZATION OF THE ENVIRONMENTAL CONSERVATION SERVICE



across the country; publishing water quality guidelines; and negotiating water quality objectives with the provinces. Research is conducted on the supply and movement of surface and groundwaters and on nutrient and toxic chemical pollution. The Branch makes an effort to publish, in both academic and popular journals, the results of their findings. A detailed description of the activities of the Water Quality Branch is available in their 1985 publication entitled "The Business of the Water Quality Branch".

Water quality monitoring facilities are operated by the Inland Waters Directorate on a user pay basis. These laboratories, which cost approximately $ 2 million to run each year, test water quality after the water has been sampled from hundreds of water testing stations in nine of ten provinces. Quebec operates its own sampling stations and laboratory (although its water scientists do follow the standard set of criteria for quality of control which are in use in the federal laboratories.) These arrangements between the provinces and the federal government are soon to be governed by a series of monitoring agreements which are currently being signed across the country.

The National Water Quality Data Bank, NAQUADAT, is a computerized data base run by the Water Quality Branch. NAQUADAT stores available data from some 10,000 stations across Canada for use by researchers in an interactive data base. Data is provided from various sources: the Branch itself is sampling at some 600 stations in 1985. NAQUADAT, which includes information on up to 1500 constituents and/or contaminants in water, can be broken down into specialized data banks. Since 1979, for example, Nova Scotia has recorded water quality data before and after treatment in water supply systems. The dictionary of methods used by NAQUADAT to analyze various water quality parameters enables researchers across the country to use consistent methods of analysis.

In 1984 the Auditor General's Report found the NAQUADAT system was functioning satisfactorily and that due regard was being paid to efficiency and economy. However, the Auditor General was less generous in his appraisal of the water testing laboratories run by Environment Canada in stating that, "water managers were obtaining limited benefit from the research being carried out in the National Water Research Institute".1/

The Environment Protection Service (EPS) is another part of Environment Canada which has an interest in water quality. The EPS leads the department's efforts to reduce the adverse impact of human activities on the environment. As part of its mandate, it works with other branches in the department to ensure that public and private parties play a role in enhancing the quality of the environment. Its activities include monitoring hazardous wastes, manufacturing processes, pesticides and other commercial chemicals, vehicle emissions, oil exploration and transportation.

EPS operates MUNDAT, the National Inventory of Municipal Waterworks and Wastewater Systems, discussed previously in Section 2.4.

EPS worked with FACE to prepare a series of courses for training operators of wastewater treatment plants. Comprehensive training packages, including slide-tape presentations, trainer's handbooks and student

workbooks, are designed to allow small groups of operating staff to receive practical training following the "need to know" principle, with limited assistance from supervisory personnel. These training packages were field tested and evaluated in Canada before being marketed on a commercial basis, nationally and internationally, by the Washington, D.C. headquarters of the Water Pollution Control Federation.

Research and development programs in Environment Canada which are related to water supply include:

a) Funds to support the Canada-United States Great Lakes Water Quality Agreement of 1978. Some $ 10 million are provided annually, mostly for research activities which aim to analyze problems and indicate remedies concerning the quality of water in the Great Lakes which is ultimately the source for public water supplies for approximately one third of all Canadians. See also Section 5.3.

b) Staff and research funds (mostly from headquarters in Ottawa) for:

   i) quality guidelines for drinking water and for natural water;
   ii) training for water supply and wastewater operators;
   iii) research into treatment technologies;
   iv) maintaining data systems (primarily MUNDAT and NAQUADAT).

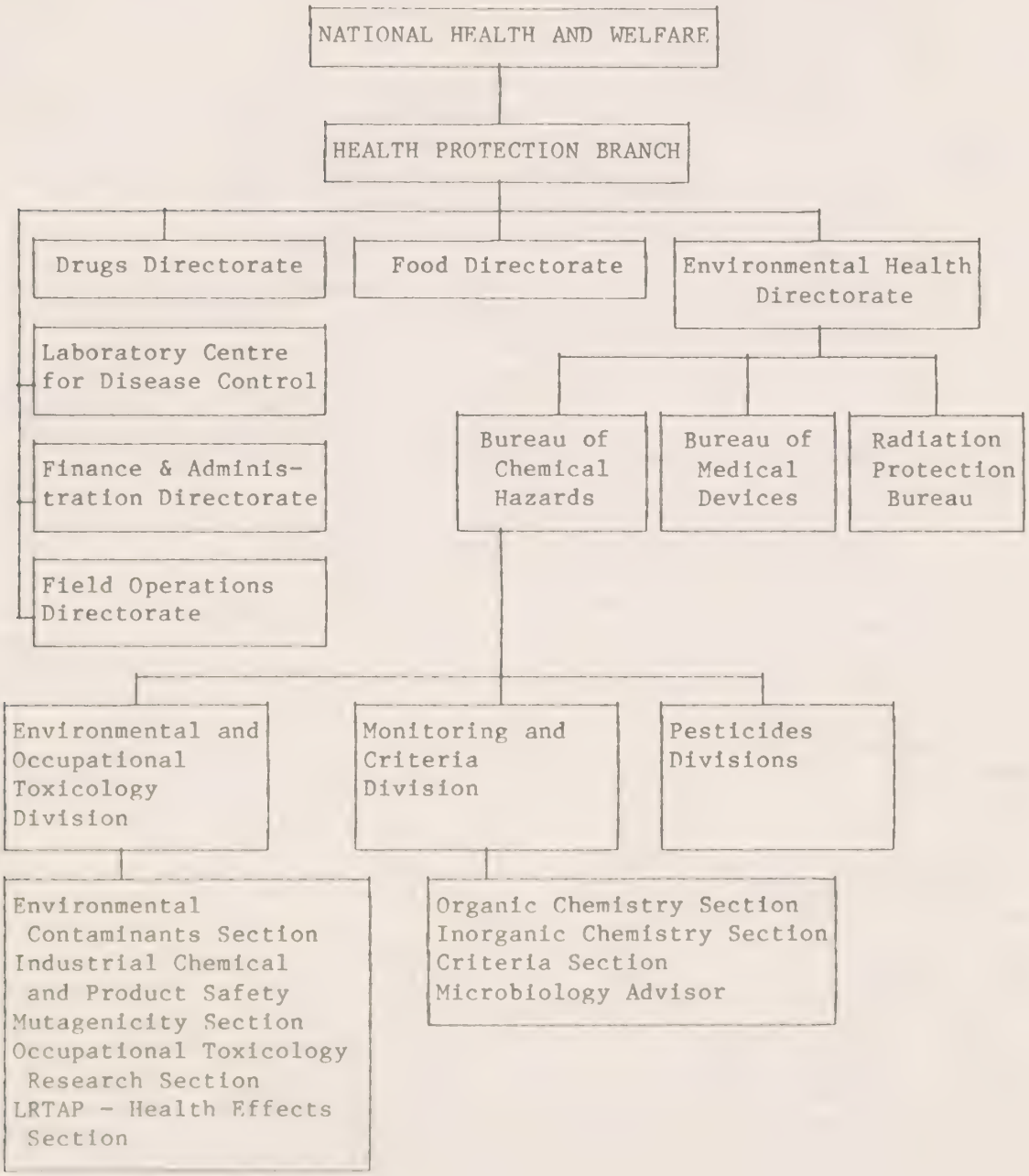
3.1.2 Health and Welfare

The Health Protection Branch within the Department of Health and Welfare is the body responsible for studying drinking water. (See Figure 3.2). Within this Branch is the Environmental Health Directorate which reviews current water legislation, reviews and updates the federal water guidelines, conducts research on the nature and quantities of trace contaminants in drinking water, and investigates ways of removing toxic materials from drinking water.

The department was primarily responsible for producing "Canadian Drinking Water Standards and Objectives - 1968" which supplanted the US Public Health Standards which has been in use for some 20 years as the basis for Canadian regulations. In 1974 the Department established a federal-provincial working group to revise the 1968 standards. The activities of this group resulted in "Guidelines for Canadian Drinking Water Quality - 1978". The current guidelines discuss physical, microbiological, chemical and radiological characteristics of water and provide recommended limits for 52 parameters. Limits, specified on the basis of health and aesthetic considerations, are of two types: maximum acceptable and objective, the latter interpreted as an ultimate quality goal. The guidelines explain the function of these limits succinctly. "The limits described herein should therefore not be regarded as legally enforceable standards unless promulgated as such by the appropriate provincial or federal agency".[3/]

FIGURE 3.2

ORGANIZATION OF HEALTH PROTECTION BRANCH



Activities relevant to drinking water quality which are underway in the Health Protection Branch include:

i) Continuing research related to the health aspects of drinking water quality, including periodic surveys for specific contaminants in drinking water supplies across Canada.

ii) Revision of national guidelines for drinking water quality. A newly constituted federal-provincial working group first met in June, 1983 to address emerging concerns, particularly about organic substances in drinking water. About 15 organic contaminants not included in the 1978 guidelines are being examined, as well as pesticides.6/

iii) Research in water treatment technology, particularly point-of-use treatment devices such as activated carbon filters and ultraviolet light devices.

iv) Training of operators. Seven provinces and the department have supported the National Water Works Operators Training Program under which FACE is preparing training materials.

v) Discussions with provincial government officials concerning possible new legislation concerning drinking water.

Drinking water is considered an important activity within the Environmental Health Directorate. Some 10 person years out of 82 within the Bureau of Chemical Hazards are attached to this activity. Drinking water research activities are concentrated on work related mainly to drinking water guidelines and toxic chemicals, involving annual expenditures of the order of $ 1.2 to $ 1.4 million over the past five years. As well, more than $ 450,000 is spent each year on contract research.

3.2 Interdepartmental Activities

The federal government has recognized the problems of shared responsibilities at the federal level and, as a result, has attempted to ensure communications and cooperation among all of the departments involved in water quality through the use of interdepartmental committees. The Interdepartmental Committee on Water contains federal departments which serve as permanent members, including, Environment Canada; National Health and Welfare; Agriculture Canada; Energy, Mines and Resources; Fisheries; Public Works; Transport Canada; Regional and Industrial Expansion; and Indian and Northern Affairs. Under this major committee is a sub-committee on Water Quality Objectives.

An additional forum for interdepartmental discussions. The Interdepartmental Committee on Toxic Chemicals (ICTC), of which a sub-committee on drinking water safety meets on a regular basis. This sub-committee has recently prepared an action plan. Unfortunately this plan was not made available for our review.

3.3 Federal-Provincial Activities

It seems evident, based on interviews we have conducted with various government officials, that both the federal and provincial levels of government have tried hard, over the last few years, to improve the state of federal-provincial relations in this sector. To this end, a series of consultation committees have been formed which were designed to act as a forum for discussion about issues of common interest. There is a well defined consultation process through the Conference of Ministers of Health which meets periodically on matters pertaining to health issues. The Deputy Ministers have established an Advisory Committee on Environmental and Occupational Health comprised of public officials at the Assistant Deputy Minister level. This committee is drawn from all relevant federal and provincial departments which have some interest in environmental and occupational health. For instance, from Ontario there are representatives from the Ministries of Health, Labour and Environment. The Advisory Committee is empowered to establish ad-hoc committees of a non-continuing nature. One of these, the Working Group on Drinking Water, was formed in 1983 to revise the national guidelines for drinking water (previously described in Section 3.1.2).

On the environmental side, Ministers have formed a Canadian Council of Resource and Environment Ministers (CCREM) which has served as an important review mechanism. This committee is chaired in successive years by different Ministers of the Environment. By all accounts, this group has functioned well and has served as a good example of cooperation between levels of government. At its October, 1983 meeting the CCREM formed a task force which is currently drafting Canadian guidelines for water quality. The guidelines will define the quality objectives for lakes, rivers and groundwater that are intended sources for drinking water supply.

A number of federal-provincial agreements exist which have bonded the relationship between the two levels of government. One such agreement which touches on drinking water is the Canada-Ontario Agreement respecting Great Lakes Water Quality. The agreement provided for the implementation by Canada and Ontario on a number of commitments assumed by Canada under the 1978 Canada-United States Great Lakes Water Quality Agreement, discussed in Section 3.5. Annex 1 provides details of two federal-provincial agreements concerning water quality.

3.4 Federal Financing of Capital Costs

Very large expenditures have been and continue to be incurred throughout Canada to provide water supplies and wastewater disposal systems, as illustrated by Statistics Canada data in Table 2.7. In 1983, for example, an estimated $ 1,069 million was spent on water supply systems and a further $ 836 million on wastewater disposal systems*/. These figures represent annual costs totalling roughly $ 75 for every man, woman and child in Canada.

*/ A further $ 514 million were spent in 1983 on tile drains, drainage, ditches and storm sewers to remove rainwater.

The expenditure data in Table 2.7 reveal some interesting trends. Expenditures for both water supply and wastewater systems have risen continuously in current dollars, from a total of $ 635 million in 1973 to $ 1,906 million in 1983. Stripped of inflation, however, the expenditures have been much more consistent, as can be seen from the last column of Table 2.7. Expenditures totalled between $ 1.9 billion and $ 2.2 billion (constant prices of 1983) in each year since 1974.

Whereas wastewater system expenditures exceeded those for water supply from 1970 to 1977, water supply expenditures have been greater from 1978 onwards, reaching $ 1,070 million in 1983.

Where do the massive sums come from to finance these capital costs? The expenditures are mainly incurred by the municipalities. A portion of these expenditures are financed from recurring revenues (tariffs and municipal taxes) but the greater part comes from local sources of capital (bond issues and grants from developers) and from provincial sources (loans and grants).

The federal government has contributed many hundreds of millions of dollars to help finance construction of water supply and wastewater systems. A wide variety of programs and federal agencies have been involved, apparently with little common policy direction. Our research indicated that no government department can provide a comprehensive account of expenditures and results from federal financing for water supply and wastewater systems, which may be the federal government's greatest financial involvement in the entire water resources area. A partial description of the more important funding programs follows.

3.4.1 Canada Mortgage and Housing Corporation (CMHC)

Between 1960 and 1980 CMHC provided a total of almost $ 2.8 billion (current dollars) in loans and grants for municipal water supply and wastewater infrastructure under three related CMHC programs, as outlined in Table 3.1. Although the CMHC programs were initially set up to help finance sewage treatment plants and trunk sewers, water supply was also included from 1975 onwards. The CMHC funding program was cancelled in November, 1980.

Funds provided by CMHC under these programs increased considerably during the 1970's, reaching a total of some $ 430 million in 1978, as shown in Figure 3.3. These CMHC loans and grants have been converted to constant (1982) dollars in Figure 3.4, which also shows total capital expenditures on water supply and sewerage in the period 1956-1982. In the period 1961-1974 the CMHC Sewage Treatment Program financed, on average, 46% of total sewerage expenditures across Canada. CMHC funding reached its peak during the Municipal Infrastructure Program of 1975-78, during which period these funds represented 35% of all capital expenditures on water supply and sewerage. The Community Services Contribution Program (1979-80) financed 10% of national expenditures on water supply and sewerage during this period.7/

The rationale for federal expenditures through the CMHC program for municipal infrastructure was summarized as follows.

Table 3.1

SUMMARY OF CMHC ASSISTANCE FOR MUNICIPAL INFRASTRUCTURE, 1961 TO 1980

Program	Number of Loans and Grants	Loans	Grants	Total	Key Points
		$ 000			
Sewage Treatment Program (1961-74)	2,896	979	131	1,110	Applied to sewage treatment plants and trunk collector sewers only, in any area. Loans up to 66 2/3% of eligible costs at interest rate slightly above federal borrowing rate. 25% of such loans to be forgiven.
Municipal Infrastructure Program (1975-78	1,618	1,025	395	1,420	Applied to sewage treatment plants and trunk collectors and to storm sewers and water supply in previously undeveloped areas. Loans and forgiveness or grant of 1/6 of project cost if loan obtained elsewhere.
Community Services Contribution Program (1979-80)	1,613	-	221	221	Applied to water supply, sewerage and storm drainage facilities in new and existing areas. Annual "bloc" funding to provinces who became responsible for administration. Amalgamated Municipal Infrastructure Program with other CMHC community programs (e.g. Neighbourhood Improvement Program).
TOTAL	6,127	2,004	747	2,751	

Source: Paul D. Birchan and Wayne K. Bond; The Impacts of Land Use on CMHC Municipal Infrastucture Assistance, 1961 to 1980; Working Paper No. 32; Lands Directorate, Environment Canada; March, 1984.

Table 3.1

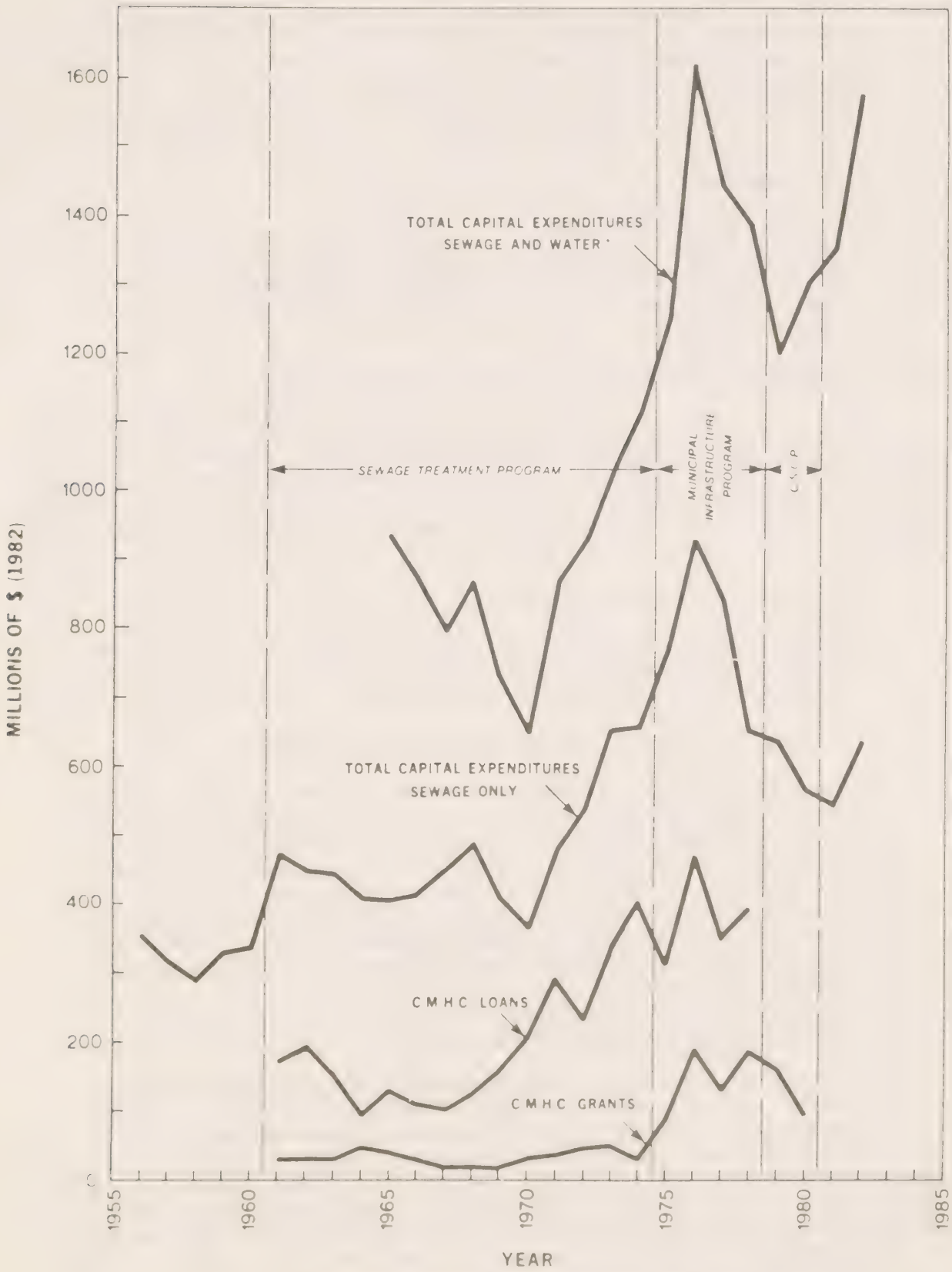
Figure 3.3

C.M.H.C. MUNICIPAL INFRASTRUCTURE FUNDING
1961 TO 1980 (CURRENT DOLLARS)

Source: Paul D. Birchan and Wayne K. Bond; The Impacts of Land Use on CMHC Municipal Infrastructure Assistance, 1961 to 1980; Working Paper No. 32; Lands Directorate, Environment Canada; March 1984.

COMPARISON OF C M H C MUNICIPAL INFRASTRUCTURE FUNDING WITH CAPITAL EXPENDITURES FOR SEWERAGE AND WATER SUPPLY, 1956-1982 IN CONSTANT (1982) DOLLARS.

Figure 3.4



* STORM DRAINAGE PROJECTS NOT INCLUDED

Source: Paul D. Birchan and Wayne K. Bond; The Impacts of Land Use on CMHC Municipal Infrastructure Assistance, 1961 to 1980; Working Paper No. 32; Lands Directorate, Environment Canada; March 1984.

a) The threat to national survival from indiscriminate and uncontrolled waste disposal is of national importance and is, therefore, of concern to the Federal Government.

b) The Federal Government should provide leadership in solving the problems of urban environment, including financial help, if necessary.

c) Without increased expenditure in the area of municipal sewage disposal, no significant environmental improvement is possible, and in order to bring about efficient investment of public funds, control and monitoring measures will have to be implemented.7/

3.4.2 Department of Regional Economic Expansion (DREE)

Created in 1969 and eliminated by the government reorganization of 1983, DREE absorbed several programs which had been active in the water supply and wastewater sector. Although various infrastructure programs have been financed by DREE, no comprehensive summary of these various programs can apparently be provided. However the following programs are relevant:

a) Atlantic Development Board (ADB)

Between 1962 and 1969, ADB financed 46 water supply and sewerage systems in the four maritime provinces, with approved total expenditures of $ 23.3 million8/.

b) Prairie Farm Rehabilitation Administration (PFRA)

The Agricultural Service Centres Program of the PFRA, introduced in Manitoba and Saskatchewan in 1972 and Alberta in 1973, provided technical and financial assistance for the construction of municipal water supply and sewerage systems. A total of 54 agricultural centres had been designated to receive federal funding totalling $ 54 million (half in grants and half in loans)9/. The responsibility of PFRA was transferred for DREE to the Department of Agriculture in March, 1983.

c) General Development Agreements (GDA)

Subsidiary agreements completed with the various provinces often included funds for water supply facilities. "Water Development For Regional Economic Expansion and Drought Proofing" was the subject of subsidiary agreements signed with Saskatchewan and Manitoba in 1979 and 1980 respectively. Federal contributions totalled $15.3 million in Saskatchewan and $9.0 million in Manitoba. Both included community water storage projects and sub-regional water delivery schemes to be assisted by PFRA.

d) Economic Regional Development Agreements (ERDA)

In 1981 the federal government agreed to provide $ 120 million for wastewater treatment plants in the Montreal Urban Community and suburbs, representing 60% of estimated costs of the program.

In May, 1984 Canada and Saskatchewan signed a sub-agreement under ERDA to construct a granular activated treatment plant to improve the quality of the Regina-Moose jaw drinking water and thus correct a serious taste and odour problem persisting in summer months. Under this agreement, the federal government will contribute up to $ 5 million or 50% of eligible expenditures towards the construction of the treatment plant.

3.4.3 Environment Canada

Several of the Department's programs have included funding for water supply and wastewater facilities.

a) Canada-Ontario Agreement Representing Great Lakes Water Quality

This 1982 agreement reflects Canadian commitments under the updated Canada-United States Great Lakes Water Quality Agreement of 1978. By this agreement the federal government has provided funding in the period 1982-85 totalling $ 65 million for municipal sewage treatment systems in Ontario.

b) Special Recovery Capital Projects

Under this 1983 program, introduced by the Minister of Finance, the federal government contributed up to $ 4 million or 50% of construction costs for a secondary sewage treatment facility for the municipality of Niagara; up to $ 3 million or 50% of construction costs for a community water treatment and supply system for Timmins; and up to $ 2.5 million or 50% of construction costs for servicing the Algonquin Road area of Sudbury with sewers and water supply. Federal contributions for water and wastewater facilities, administered by Environment Canada, thus amounted to $ 9.5 million out of almost $ 2.2 billion allocated for the total program.

3.4.4 Department of Indian and Northern Affairs

Infrastructure systems serving Indian reserves are financed by this Department. Budget data in Table 3.2 indicate that expenditures were expected to total some $ 55 million in each of the past two years, less than 19% of the Department's total budget in this period. Substantially more money has been committed for water supply systems than for sanitation systems.

Table 3.2

BUDGETED EXPENDITURES BY DINA FOR WATER SUPPLY AND SANITATION SYSTEMS

Year	Water Supply	Sanitation	Total
		$ 000	
1983/84	34,522.0	19,931.6	54,453.6
1984/85	30,080.0	24,885.0	54,965.0

Source: Department of Indian and Northern Affairs.

3.4.5 National Capital Commission (NCC)

Wastewater system costs in the national capital region in Ontario and Quebec are being shared by the federal government.10/ In 1970 NCC agreed to provide $ 17.1 million for wastewater treatment plants in the Ottawa-Carleton region in Ontario. In 1972 NCC agreed to provide $ 52.4 million for the facilities in the Outaouais Regional Community in Quebec (in addition to $ 22.0 million provided by CMHC under its infrastructure program).

3.5 International Activities

Only the federal government can represent Canada officially in dialogues or legal agreements with other countries or international organizations. There are relatively few international activities concerning drinking water.

Canada and the United States share a long boundary and many water bodies. The International Joint Commission (IJC) was created by the Boundary Waters Treaty of 1909 to prevent disputes and to resolve problems referred to them by the signatories. Both Canada and the USA appoint members to the IJC but its only powers of decision relate to approving works on either side of the border which would have an effect on the level and flow of water on the other side. In matters of water quality the IJC can only advise member governments, but such advice can be very important. IJC studies and reports, based on technical boards composed of government experts and on input from public hearings, were largely responsible for the Great Lakes Water Quality Agreements of 1972 and 1978 between Canada and the USA.11/

The federal government cannot, on its own, discharge all the Canadian obligations under boundary waters agreements such as the Great Lakes Water Quality Agreement. Hence the Canada-Ontario Agreements on Great Lakes Water Quality, whereby the federal government collaborates closely with the province of Ontario in the context of the Canada-USA agreements. Recent activities under this federal-provincial agreement place great emphasis on the control of toxic substances and pollution from various urban and rural sources within Ontario, programs which directly affect the quality of drinking water sources used by millions of Canadians.

Ad-hoc arrangements can be made to address specific international problems related to water supply. For example the Niagara River Toxics Committee was formed in 1981, to cooperate in a joint investigation of toxic chemicals entering that international river, with representatives from the federal government (Environment Canada) and Ontario (Ministry of the Environment) and from the United States Environmental Protecion Agency and New York State (Department of Environmental Conservation). Such a committee can only be advisory in nature but can nevertheless carry out essential research and provide recommendations for consideration by governments and the public.12/

Federal government officials regularly represent Canada in international agencies. The World Health Organization (WHO), for example, produced its 1984 Guidelines for Drinking Water Quality with extensive assistance from officials of the Health Protection Branch of the federal Department of Health and Welfare. Such participation enables Canadian experts to appreciate research and related activities underway internationally as well as to contribute to such endeavours.

WHO activities under the Global Environment Monitoring System include participation by Canadian experts from the federal Departments of Environment (particularly the Canadian Centre for Inland Waters at Burlington) and National Health and Welfare. Research activities under such programs may be of considerable relevance concerning water quality and public health issues.

Canadian participation at international conferences related to drinking water is usually by means of delegations led by federal officials but including other representatives. At the United Nations Water Conference in Mar del Plata, Argentina in 1977 the 25-member Canadian delegation was led by Senator R.V. Perrault and assisted by the Environment Minister of Manitoba, who was then the Chairman of the Canadian Council of Environmental Resource Ministers13/. It was that conference which promoted the International Drinking Water Supply and Sanitation Decade which was formally announced by the United Nations (on a motion seconded by Canada) in November, 1980.

The Canadian International Development Agency (CIDA), a federal government organization, assists developing countries in many ways, including support of the order of $ 30 million annually for water supply and sanitation systems. CIDA has its own staff and occasionally seconds staff from federal government departments but has no formal relationship in this regard with any Canadian organization.

The International Development Research Centre (IDRC), funded by Parliament, supports research in developing countries. One area of research concerns appropriate technologies, particularly handpumps, to provide drinking water supplies. IDRC does not support comparable research for application in Canada.

4.0 USA EXPERIENCE IN MANAGING DRINKING WATER

Experiences in the USA are of particular interest to Canada because we are strongly influenced by American public policy. This chapter examines recent experience in the USA in the management of drinking water supplies.

4.1 Background

More than 200 million people are served by slightly more than 220,000 public systems in the United States and its territories[1]. Within this context, surface water is the primary source for 18.9% of the public community systems, which in turn serve almost two-thirds of the general population. Groundwater serves a little more than one-third of the population while being the primary source for more than 80% of the public community systems.

While systematic research into water quality standards may have, in part, contributed to congressional interest into questions of water safety and clean water supply, the likely major source of input was the increased public concern and agitation for clean drinking water legislation.

In 1969, due to public pressure, a study was commissioned to investigate the organic quality of the Mississipi River in Louisiana. During the study the finished drinking water from one of New Orleans treatment plants was sampled. The report, published in 1972, listed 36 organic compounds isolated from the samples collected at that site[2]. This finding led to a series of other revelations about water quality culminating in the release of a three part series in Consumer Reports in 1974. In these reports, the authors concluded that "the long-term effects of consuming small quantities of the other New Orleans drinking water contaminants, identified and unidentified, are unknown".[3]

Having made the issue of drinking water quality a public one in response to the public's demand for action, the Environmental Defence Fund (EDF), a public advocacy group, commissioned an epidemiological study in the New Orleans area to compare cancer death rates from communities using the lower Mississipi River as drinking water source with those from nearby communities using groundwater sources for drinking water.

The report, released to the press in the latter quarter of 1974,stated that persons drinking treated Mississipi River water had a greater chance of developing cancer than those in neighbouring areas whose drinking water came from ground water sources[4].

The federal government also responded to the public's call for action by conducting a survey to determine, to the extent possible, the identities and the quantitative concentrations of trace organic compounds that might be present in the finished water of New Orleans and surrounding communities. This second study, completed at the same time as the former one, identified 66 organic compounds in the water and detected 20 others.

Public awareness was further heightened when the discovery was made, around the same time that the EDF and federal government studies were being completed, that "when free chlorine was used during the disinfection process, a class of organic compounds was formed during water treatment, thereby appearing in the finished water, even though absent in the source waters"2/. Moreover, the circumstantial occurence of all of these events attracted national and regional media attention culminating in a national report prepared by CBS television news entitled "Caution, Drinking Water May be Dangerous to Your Health" which aired nationally in prime time on Dec 5, 1974.

Pressure for federal legislation was also aided to some extent by a longstanding tradition in the United States for the national government to act in this area. In fact, in the United States, regulations governing drinking water quality date from 1893 when the US Congress enacted the Interstate Quarantine Act. Under this act, the government could enforce regulations aimed at stopping the spread of communicable diseases across state and national borders. Over the years, the federal government moved more directly into the drinking water area by adopting a series of drinking water standards. Interestingly, although the rules applied to areas of federal competence such as interstate commerce, many state and local governments adopted these standards as their own. By the end of 1962 these standards were "endorsed by the American Water Works Association and accepted by all 50 states with minor modifications either as regulations or guidelines"5/. These standards were federally enacted and they were limited as an enforcement tool since the vast majority of waterworks were subject to state and local authority. In 1969, it again decided to revise previously issued standards in light of new scientific discoveries (especially organic contaminants) of new forms of pollutants and improvements to measuring devices.

One further impetus for major drinking water legislation was the establishment of the Environmental Protection Agency (EPA) in 1970 under the sponsorship of the Nixon administration and the agency's early decision to conduct a comprehensive study of water supplies in the US. The report was devastating in its tone. Of the more than 900 public water systems which were studied, more than 40% of the systems did not meet the limits established in the 1962 drinking water standards. The report revealed a whole host of problems which pointed to the need for a complete overhaul of the water supply and discharge system. Moreover, it was also noted that smaller facilities appeared to have a larger preponderance of problem areas than did larger ones.

These findings were important in exploiting the myth that drinking water in America met the public's expectations. With the strong support of a number of government departments, especially the Environmental Protection Agency, the Congress signed into law a Safe Drinking Water Act on December 16, 1974.

The passage of the Act led immediately to calls for government intervention on the grounds that the presence of carcinogens in the drinking water of five US cities represented a substantial endangerment to the health of persons. The government responded by commissioning further studies although it was evident, at that time, that environmental groups

would use the legislation to pressure the utilities and would not be held back awaiting the research report. While Americans are generally more likely than Canadians to use the courts to resolve their differences, we note how legislation such as the Safe Drinking Water Act can serve as a focal point for public concerns.

4.2 Safe Drinking Water Act of 1974

In essence, the Safe Drinking Water Act (SDWA, Public Law 96-502, as ammended) sets out to constitute a cooperative venture among the federal, state and local levels of government, by requiring the establishment of consumer oriented drinking water regulations. The act was designed to encompass all public water systems in the United States[6/].

In the Act, the Administrator of the Environmental Protection Agency was required to produce an interim set of drinking water regulations within three months of the Act coming into force and to be finalized three months later. These regulations were to take effect no later than 18 months after the date of their promulgation. These regulations were essentially to specify a maximum contaminant level which, in the judgment of the Administrator, may have an adverse effect on the health of any individual. These regulations were to be reviewed every three years or sooner depending on whatever changes in technology, treatment techniques and other means would permit greater protection of the health of persons.

In this Act, the states are given the primary responsibility for enforcing the regulations. In cases where individual states have not complied with the regulations or attempted to procure a variance to the general order, the Administrator has the right to commence civil action against the offending state. Moreover, when a particular owner of a public water system has been cited to be in violation of the regulations, he or she must inform all persons served by the water system of the situation. As well, the public must also be informed through the media once very three months until the problem is rectified.

The Act also contains a provision for public hearings if, in the judgment of the Administrator, there is some need to gather information from technical or other experts. On the basis of such hearings, the Administrator can issue recommendations which will be sent to the State and public water system and also be made available to the public and media.

States can apply for variance to the application of these guidelines although the Administrator, if in his or her judgment the state has abused this section of the Act, can insist the state in question justify its behaviour and call for public hearings if necessary. There is also a provision in the Act for a given state to seek an exemption to the regulations but only due to compelling factors (which may include economic matters) or a grandfather clause for pre-existing systems and this exemption does not represent an unreasonable risk to health.

The Act also gives the federal government extraordinary powers with which to act in the event it is determined by the Administrator that there is an immediate threat to health and that state and local people have not

taken the necessary steps to avoid the problem. As well, the Administrator can commence a civil action to provide the appropriate relief to those in need and to order a temporary or permanent injunction.

The Act provides for the assurance that adequate supplies of chemicals necessary for water treatment are available to water treatment plants. In the event of a shortage, the Administrator, once again, can move in to ration supplies and to order the production of the required chemicals.

Finally, the Act strongly supports the notion of basic water quality research by providing funds for studies, technical assistance, information programs and training of water personnel. In addition, funds are also available to the states for their own programs and to test pilot projects. These latter activities will be financially supported by Congress for both capital and operational costs.

4.3 Review of the Safe Drinking Act of 1974

The Safe Drinking Act set in motion two major program intitiatives, one aimed at ensuring the safety of the nation's public water supplies and the other designed to protect underground sources of drinking water from contamination.

The groundwater strategy developed by USEPA has four main components:

i) increased support for the development of groundwater protection programs at the state level;
ii) assessment of contamination threats to groundwater;
iii) federal guidelines for groundwater protection, with groundwaters divided into three categories, according to their value and vulnerability;
iv) development of a new Office of Groundwater Protection within USEPA to focus on groundwater.7/

The Safe Drinking Water Act requires the EPA to establish primary drinking water regulations which apply to public water systems, specify contaminants which in the judgement of the Administrator may have any adverse effect on the health of persons, and specify for each contaminant either maximum contaminant levels or treatment techniques. A treatment technique requirement would only be set if "it is not economically or technologically feasibile" to ascertain the level of a contaminant in drinking water.

The process of issuing regulations regarding drinking water standards is a three step system. First, according to provisions in the Act, a set of national interim drinking water regulations were issued by EPA in which the maximum contaminant level and monitoring and reporting requirements were set for some 40 substances in five categories (microbiological, inorganic, organic, turbidity, and radionuclide). The regulations were issued in 1975 and became effective in 1977. According to EPA publications these standards were primarily derived from the 1962 standards. These regulations wre amended in 1976, 1979 and 1980.

The USEPA developed the interim regulations by intitially establishing recommended maximum contaminant levels and then fixing maximum contaminant levels (MCL) as close to the previously recommended set as was feasible. These recommended maximum contaminant levels are non-enforceable health goals and are to be set at a level which in the Administrators judgement, "no known or anticipated adverse effects on health of persons occur and which allows an adequate margin of safety". (Section 1412(b)(1)(B)). In cases where there is no safe threshold for a contaminant, the recommended maximum contaminant are set to zero level.

The MCL are the enforceable standards and are set as close to the recommended levels as feasible. Feasible for the purposes of the Act means "with the use of the best technology treatment techniques and other means, which the Administrator finds are generally available (taking costs into consideration)" (Section 1412(b)(3)). Public water systems must comply with the maximum contaminant level; non-compliance with the recommended maximum contaminant level cannot be the basis of an enforcement action under Section 1414 of the Act.

In the second step the National Academy of Sciences was asked to conduct a study to assess the health effects of contaminants in drinking water as a means for providing proposals for recommended maximum levels for known substances. This report was prepared in 1977 and was published in the Federal Register for public comments. In essence, the National Academy of Science reports provided EPA with toxicological assessments of contaminants in drinking water and based upon this information and data from other sources, EPA set out to develop the recommended maximum levels of contamination.

The third step required that EPA propose and promulgate a set of revised primary drinking water regulations to include recommended maximum contaminant levels as well as monitoring and reporting requirements for those contaminants that may have an adverse effect on human health.

In 1979 national secondary drinking water regulations were promulgated by EPA, becoming effective in 1981. These regulations, covering 12 contaminants affecting the aesthetic quality of water, are non-enforceable goals, whereas the MCL under the national interim primary water regulations are health-related and enforceable. The national interim primary drinking water regulations, as amended, and the national secondary drinking water standards are the only federal regulations governing water quality in the United States at present.

EPA's management scheme for reviewing and revising the existing interim regulations will analyze contaminants in five phases:

Phase I - volatile synthetic organic chemicals;
Phase II - synthetic organic chemicals, inorganic chemicals and microbiological contaminants;
Phase III - radionuclides;
Phase IV - disinfectant byproducts including trihalomethanes;
Phase V - other synthetic organic chemicals, pesticides and inorganic chemicals not considered previously.

The general approach for developing revised regulations for each phase is to:

i) publish and advance notice of proposed rulemaking;
ii) proposed recommended maximum contaminant levels;
iii) declare recommended maximum contaminant levels and propose maximum contaminant levels (MCLs); and
iv) declare MCLs.

USEPA initiated the revision process, now underway, by publishing its advance notices of proposed rulemaking for Phase I contaminants in March, 1982 and for Phase II in October, 1983.

One of the principal objectives of the 1974 Act is that the States would exercise primary enforcement responsibility over the program with the EPA assuming this task only where the States are unable or unwilling to meet minimum requirements which are set out in the regulations.

For both the public water supervision program and the underground injection control program, Federal grants to the States were provided, but continuing eligibility for such assistance was tied to specific deadlines for the assumption of primary enforcement responsibility.

In addition, the Act provides for research, technical assistance, demonstration grants, training and a number of special studies designed to provide important information related to measures to ensure the safety of the nation's drinking water supply.

According to EPA accounts and independent sources, early in the process EPA announced a strategy in which they committed themselves to developing the regulations and major policies related to implementation using an open process by which advice was sought from all interested parties, including industry, the utilities, the States, environmentalists, and other interested members of the public.

To aid this process the EPA established, through the legislation, an independent National Drinking Water Advisory Council composed of members from State and local governments, the water supply industry, and the public. In particular, their input was sought in commenting on the regulations although it appears that they were extremely active in other aspects of the program as well. In particular, we refer to the ways in which the Council sought out public input and was successful in soliciting useful comments which might not have been available to EPA since the agency represented to some activist groups all that is wrong with government bureaucracies.

One of the features of the Safe Drinking Water Act of interest to Canadians is the way in which the federal government attempted to bring the States along since jurisdiction for water is a shared one. At the outset it appears Congress wanted the States to take the leading role in the enforcement of the Safe Drinking Water Act by assuming primary enforcement responsibility (known as primacy). It must be emphasized that there is no such thing as "shared primacy": a state either has primacy or it does not.

A State was deemed to qualify for primacy and to operate a Public Water System Supervision (PWSS) program if it was able to meet the following conditions. First, it had to adopt regulations that were at least equal to the federal regulations in protecting public health. By this the State had to:

a) have standards for all contaminants;
b) the Maximum Contaminant Levels had to be as stringent;
c) samples had to be obtained as frequently; and
d) the analytical methods had to be equal to those in the Federal regulations.

Second, it had to adopt and implement adequate surveillance and enforcement procedures. Next, any variance and exemptions which were granted had to meet Federal requirements. Fourth, each state had to provide an adequate plan for supplying safe drinking water under emergency conditions and to keep records and provide compliance data to the EPA. The reporting system had to be capable of maintaining records on all public water systems for which the state has primacy as well. The system had to maintain at least those data elements which must be transmitted to EPA. Finally, the system had to be capable of yielding the necessary data for EPA to prepare its annual report.

Moreover, the Act also requires that the primary drinking water regulations be reviewed every three years and ammended whenever changes in technology, treatment techniques or other factors permit greater health protection.

As a further feature of the legislation, each primacy State had to include a copy of a state statute or clear common law precedent generally authorizing the appropriate agency to bring an action in court of competent jurisdiction to enjoin violations of state primary drinking water regulations. In fact, states were encouraged, although not required, to adopt a statute which expressly authorized an appropriate party to seek an injunction of any threatened or actual violation of a state primary drinking water regulation. The authority to assess penalties also had to be clearly spelled out in the State's own legislation or regulations applicable to the water program.

As part of the legislation each of the 50 states (and territories, such as Guam) of the United States would be eligible to receive PWSS program grants. Since the enactment of the legislation 45 of the 50 states have assumed primacy, starting with Oklahoma in April of 1977 and ending with Vermont in April of 1980. Five states (Indiana, Oregon, Pennsylvania, South Dakota, Wyoming) are still non-primacy states.

To assist the States, Congress provided grants to help cover the administrative burden falling on the States. The Act did not include federal assistance to help public water system attain the standards. The Congress assumed that such costs would be borne by the customers through increased rates. In those cases where water facilities are unable to meet the standards, it was expected that flexibility would be exercised in the use of exemptions and variances. Since no direct federal assistance was

made to those water facilities in need of major infrastructure improvements, it was envisaged that existing housing and development programs would provide the necessary funds.

As mentioned earlier the Act authorized federal support for the administration of PWSS programs. Since the beginning of the program, Congress has appropriated more than $ 183 million for the PWSS Grant Program in the following way:

1976	$ 7.5 million
1977	$ 20.3 million
1978	$ 20.5 million
1979	$ 29.5 million
1980	$ 36.5 million
1981	$ 36.1 million
1982	$ 33.5 million[8/]

The way in which the money has been spent in each state varies but, in general, it appears that federal funds have been appropriated in the following proportions:

Laboratory Capability	15.2%
Laboratory Certification	2.8%
Enforcement	5.9%
Public Participation	1.0%
Data Management	5.7%
Surveillance and Technical Assistance	38.0%
Training and Certification	4.6%
Plan Review	9.5%
Disease, Surveillance and Investigation	0.8%
Administration and Program Development	14.6%
Other	2.5%
Total	100.0%

The dollar amount of Federal grant assistance for which each state is eligible has been determined by applying a grant formula consisting of several weighted factors. The factors comprising the grant formula were population (weight factor .30), land area (.10), the number of community water systems (.48) and the number of non-community water systems (.12).

$$\text{State Allocation} = \frac{.3 \times \text{State Population}}{\text{National Population}} \times \frac{.1 \times \text{State Land Area}}{\text{National Land Area}}$$

$$+ \frac{.48 \times \text{State Community Water Systems}}{\text{Total National Community Water Systems}}$$

$$+ \frac{.12 \times \text{State Non-Community Water Systems}}{\text{Total National Non-Community Water Systems}}$$

Although it is difficult to secure a complete picture of the way in which the Act has worked since it was promulgated in 1974, at least one element of the legislation stands out; the States have become genuine partners in this effort. Local governments, with finanical encouragement

of the States, have increased their levels of expenditures for water treatment and management. State staffs have at least doubled in size and their programs have been substantially expanded[8].

According to EPA officials, tens of thousands of water plant operators have been trained in the regulatory requirements and in the skills and knowledge they need to achieve compliance. Local officials and the general public are reportedly better informed than ever before on the issues of drinking water quality. Much of the informational work and educational programs were conducted by the EPA and the States with the grant supported assistance of the American Water Works Association, Conference of State Sanitary Engineers, the League of Women Voters and other environmental groups[7].

Experience with the primary drinking water regulations reveals that during 1982 "more than 70,000 violations of the interim regulations were recorded by 20,000 community water systems"[9]. Most of these violations were for monitoring and reporting (84%) although the authors estimate that more than 9,000 water supply systems require improved facilities to meet drinking water standards. Problems persist with non-community water supply systems whose records were often incomplete.

Moreover, public notification is working well as an instrument of holding offending utilities to account for their actions to consumers. Corrections and improvements in water treatment plants may be attributed, in some part, to increased public awareness generated by the public notice requirements. Many violations have been corrected without any enforcement action. As well, the public notice process had also significantly increased public participation in problem solving efforts and has facilitated the improved state of water quality. EPA officials feel that the public notification requirement has proven to be a success in innovative legislation[8].

4.4 Political Reaction

Judging from the reaction of Congressmen appearing before various House of Representative and Senate hearings during discussion of ammendments of the Safe Drinking Water Act, there is still a strong commitment to the legislation although a number of recurring problems appear to have emerged. The first major problem is the perception that the Act did not give the States enough time in which to meet the maximum contamination levels set out in the regulations. Most of the criticism of this feature of the Act involved small water treatment and distribution systems which had historically been supplying "clean" water to their customers. The need for public disclosure that the system was not meeting federal standards created both financial and political hardships for those concerned. As well, it was argued that it had taken the EPA four years after the passage of the Act to issue standards, yet they were expecting that facilities would be able to meet the clean water standards only three years hence. In the end, most Congressmen arguing for change were simply looking for a broader use of the exemption allowances.

Second, there was an extensive debate regarding the special provisions in the Act pertaining to natural gas storage facilities and how the Act has placed too heavy a burden on the companies to avoid polluting adjacent underground water supplies. As a result, one of the ammendments of the Act under consideration was to delete underground storage of natural gas from the statutory definition of underground injection.

One further problem with the Safe Drinking Water Act was the feeling that many of the standards which had been promulgated were unfair in the sense that at some locations in the country where people were used to a flavour, colour or smell of water now discovered that their water was unacceptable. As a consequence some politicians were forced to support increased local government expenditures for infrastructure improvement when the public could see little point in incurring these costs.

Another area of interest to Canadians is the problems experienced by the politicians in sorting out the jurisdictional turfs of the Environmental Protection Agency and the other federal departments responsible for administering the Food and Drug Act. Since water is legally defined as a food, as it is in Canada, there is considerable overlap in the mandates of the interested parties. One solution proposed in the United States was a legislative ammendment to the relevant legislation removing water from the general definition of food thus clarifying the jurisdictional boundaries.

One further problem which emerged as a result of the legislation was the potentially economic burden imposed on some of the small communities which had to meet the various standards set by the Act. There are economies of scale in water treatment and the per capita cost of the same level of treatment for small systems is considerably greater than corresponding per capita costs for large systems. This problem became a major source of friction between EPA and various local constituents which have had to assume responsibility for the consequences of increased financial demands on their limited tax bases without any assistance from federal and state legislatures.

5.0 DRINKING WATER ISSUES AND FEDERAL OPTIONS

The principal objective of this report is to consider alternative approaches by the federal government to safeguard Canadian drinking water. The principal issues are summarized, followed by a number of possible options for federal action. These options are not exclusive: one or more could be implemented.

5.1 Lack of Federal Focus

Water supplies are essentially a local responsibility in Canada, with the provincial governments providing the basic technical and financial support to the municipalities. The federal government, which has international responsibilities in the sector, also provides technical and financial assistance nationally through a variety of programs and agencies. Environment Canada, in their submission to the Inquiry, explained that a total of 22 federal departments and agencies have some interest in water matters in Canada. The issue is that federal activities related to drinking water are not sharply focussed and in some cases appear uncoordinated.

If any Canadian citizen or parliamentarian wanted information on drinking water quality in any part of Canada, or in all parts, it is unlikely that he would know where to address the question within the federal bureaucracy. The group most concerned with drinking water quality is located within the Environmental Health Directorate of the Health Protection Branch of the Department of Health and Welfare. Yet this group comprises mainly research scientists who cannot work full time on water quality because of the other responsibilities for which this group is responsible (Section 3.1.2).

Existing federal expertise for drinking water is scattered throughout the bureaucracy, with no agency having the mandate for a comprehensive overview of all aspects of drinking water issues. Health and Welfare experts are medically and scientifically oriented, whereas those in Environment Canada who are concerned with water supplies (primarily engineers and scientists) are mainly concerned about water quality in the overall environment.

Even if a questioner located a knowledgeable water supply person in the federal government, detailed information comparing actual drinking water quality with the national guidelines for drinking water quality could not be provided, because the federal government has no means for systematically recording the limited information which does exist.

Moreover, the federal government has provided hundreds of millions of dollars in recent years to help local authorities build and improve public water supplies (Section 3.4). Yet nowhere can be found a complete record of these programs, their objectives, the actual expenditures and the results achieved.

Canada, through its international efforts at the World Water Conference in 1977 and at the United Nations in 1980, has been instrumental in promoting the International Drinking Water Supply and Sanitation Decade,

1981-1990. The objective is that everyone in the world will have safe drinking water and adequate sanitation by 1990. Having promoted the decade vigorously, however, Canada has yet to enunciate any policies, strategies or programs to ensure that Canada itself meets the goals of the Decade. Based on present progress, it seems most unlikely that such goals will be met completely within Canada, particularly in Indian and northern communities.

This lack of federal focus on drinking water, as on water resources generally, handicaps any efforts to analyze water supply questions systematically and effectively from an overall national perspective. It also frustrates efforts of provincial governments, local governments and various interest groups in dealing with the federal government in this important matter.

Federal options include:
- continuation of the present situation;
- more coordination of all activities of existing departments concerned with water supply matters;
- consolidation of existing federal programs and support services through an existing single department such as Health and Welfare or Environment Canada.
- fundamental reorganization, perhaps resulting in the creation of a new agency responsible primarily for water supply and wastewater programs, as with the Environmental Protection Agency in the USA.

5.2 Public Information and Public Participation

One of the recent trends in public policy formation during the last few years has been the increase in the use of public participation in formulating and articulating options to government. Water quality is an emotional as well as a scientific issue but, to date, almost all of the dialogue regarding water quality has been among scientists, engineers, medical researchers, and public health officials in the carrying out of their professional responsibilities. It is apparent from the USA experience and some of the testimony of the Inquiry that more public participation would be welcome as a means of opening up the policy input process. The issue is whether and how the federal government can encourage such public participation about drinking water quality.

There seems good reason to regard water quality as much a social and economic issue as a health one. We know that the water industry is capable of providing "pure" drinking water*/ but we do not know whether the public

*/ Water which is chemically "pure", containing no contaminants whatsoever, hardly exists in nature and would be unacceptable to most consumers, as it lacks "taste". What the public may want is water of the highest quality, with no contaminants associated with any significant risks to health.

is willing to pay the cost for achieving this goal, nor whether there are any further benefits that accrue to society for attaining this goal. In other words, will less than perfect drinking water quality suffice in terms of health, social and economic benefits?

We know, in principle, that waters of varying degrees of quality pose different health risks, even though it is extremely difficult to quantify these risks with confidence. It makes sense to seek out the opinions of as broad a spectrum of our society as possible to decide on what level of risk they are prepared to accept, bearing in mind the costs of reducing such risks.

At the very least, the public should be given the opportunity to become informed about the quality of the water which it drinks in order to make the types of decisions it must regarding water quality standards and levels of risk.

Federal options include:

- continuation of the present limited programs for obtaining public input;
- conducting research into the issue of economic and social costs of providing water of the highest quality. Also research into acceptable levels of risk and policy options;
- informing the public of the actual state of drinking water quality and present uncertainties regarding health risk;
- making deliberate efforts to assist the public throughparticipation in the process of defining acceptable and affordable levels of drinking water quality.

5.3 Drinking Water Guidelines

The first federal standards for drinking water, promulgated in 1923, related to the bacterial quality of water used for drinking and culinary purposes on ships on inland waters. Canada's current drinking water quality guidelines were completed in 1978 after several years of work by a federal-provincial working group and have been published by the Department of Health and Welfare. A revised set is currently under preparation. There are two basic issues concerning guidelines. Are they sufficiently comprehensive? Should they be made mandatory?

The issue about the scope of the guidelines is easily seen in the context of concern over drinking water from the Great Lakes. About 40 million people, including some 7 million Canadians, live in the watershed of the Great Lakes. Roughly 5 million people in Ontario get their drinking water from the Great Lakes and more than half this number in Quebec use the St. Lawrence River, which drains the Great Lakes, as their water source. An estimated 30,000 chemical compounds are being used in the basin and the IJC has identified about 800 toxic compounds present in the lakes[1]/ but there is limited information presently available on the toxic compounds present in water supplies. Canadian drinking water guidelines refer to some 52 physical and chemical parameters. Is it possible that water which met all the parameters of the guidelines could nevertheless be dangerous to human health? The answer is uncertain.

Canada, USA, Ontario and New York have representatives on the Niagara River Toxics Committee, which was formed in 1981 to examine toxic chemicals entering this river. The committee established a list of 261 man-made chemicals present in the river and identified 57 Group I chemicals, requiring immediate attention, which "have been detected at least once at levels which exceed some human health or environmental criteria or are considered to pose a human health or environmental risk". Some 170 Group II chemicals "have been identified as having the potential to adversely affect the Niagara River ecosystem in some way. At the present time, the data are incomplete so that a thorough assessment of all of these chemicals cannot be made". Some 34 chemicals were screened into Group III, requiring very little attention[2/].

The conventional processes available to water supply authorities in communities using Niagara River or Great Lakes water are not designed to remove the various hazardous chemicals which have been positively identified in the water. If treated water from this source were tested, it is entirely possible that many of the identified chemicals would still be present*/.

The foregoing information above serves to illustrate that existing guidelines do not address all the possible contaminants in water which can jeopardize human health. But the issue is obviously very complex, since determining the long term health impacts of so many contaminants, alone or in combination, may be impossible. More contaminants are being produced and discovered in water sources all the time, and the scientific basis to determine their long term health impacts is far from clear. In other words, no guidelines can ever be devised which can cover all potential contaminants in drinking water.

In this context, it is worth noting that any guidelines which are adopted by the government must be demonstrably sensible. "Standards set by any regulatory agency must have high scientific credibility"[3/]. This means that guidelines should only be published after extensive and carefully verified research which is above challenge by scientists.

The second issue is whether or not drinking water guidelines should be mandatory and enforceable. As previously noted, the existing national guidelines are only advisory and cannot be enforced. Quebec is the only province with drinking water quality regulations which are legally enforceable. We note that others have examined whether the federal government has the constitutional right to legislate in this matter, including submissions to the Inquiry by FACE, Health and Welfare Canada, and by the Canadian Environmental Law Association. No simple answer exists to this fundamental question. We are not persuaded that the federal

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*/ Answers to such speculation may be forthcoming after completion of a study initiated in November, 1984, jointly by Health and Welfare Canada and Ontario Ministry of the Environment, in conjunction with the Canadian Centre for Toxicology. Due for completion by mid-1985, this study will examine raw and treated water quality from Lake Ontario, along with treatment technologies and will evaluate the health implications of the findings.

government has a constitutional right to institute national regulations concerning water quality which are legally enforceable, except on federal lands.

Federal options include:

- continuation of the present situation, including the ongoing improvement of national guidelines for drinking water quality;
- adoption of legislation to create national drinking water standards which are legally enforceable, at least on federal lands;
- encouragement of provincial governments to legislate drinking water standards, based on the national guidelines, which are legally enforceable (except for Quebec which has already done so).

5.4 Monitoring Drinking Water Quality

Relatively little information exists about the quality of drinking water actually supplied to Canadians. That which exists is not systematically recorded and generally available to interested parties.

Health and Welfare Canada, in conjunction with the provinces, carries out considerable research to provide the scientific basis for the national guidelines for drinking water, including periodic and ad-hoc analyses of particular contaminants, their toxicology and health impacts. Research results are published by the department and in scientific journals. But no regular and systematic process exists for gathering and analyzing data about drinking water quality throughout Canada.

A recent survey concerning drinking water quality surveillance activities by the provinces (all but Alberta replied) has indicated that water quality was not being monitored in accordance with existing guidelines[4/].

The national guidelines specify limits for 52 chemical and physical parameters (apart from radioactivity). Of these, 25 parameters are not routinely monitored in any of nine provinces and six were monitored in only one province. Only hardness was routinely measured everywhere. Colour, turbidity and pH were routinely measured by most provinces. Interestingly, iron and manganese were routinely measured by eight and seven provinces respectively, presumably because excess quantities of these will cause staining of laundry and plumbing fixtures (thus leading to consumer complaints). In contrast, only five provinces check lead content and three arsenic content. In other words, it would appear that current monitoring practices are concerned more with ensuring that the water is aesthetically acceptable than in assuring its safe quality.

The drinking water guidelines also specify that sampling should be conducted at semi-annual intervals, except where experience shows a contaminant to be consistently absent, when the frequency of sampling may be reduced. Those provinces prepared to comment on sampling frequency admitted to much less frequent examinations than specified in the

guidelines. One province (B.C.) had discontinued routine surveillance of all parameters, except in response to consumers' requests, as an economy measure.

The issues is that there is little point in worrying about drinking water guidelines or regulations unless comparable attention is paid to the question of monitoring drinking water quality.

Federal options include:

- acceptance of the present situation;
- urging municipalities and provinces to expand monitoring practices, if necessary by publicizing failures to monitor, as suggested in the draft private members's bill on drinking water in Canada (Section 2.3.1);
- a more comprehensive federal program of monitoring drinking water quality;
- developing, with the provinces, a national program for monitoring drinking water quality;
- publishing available data on drinking water quality routinely or, alternatively, publishing only results showing poor water quality.

5.5 Protecting Drinking Water Sources

In the past, the water supply authorities designed their treatment processes to handle the untreated or raw water as it existed at the selected local source. Earlier treatment philosophies aimed to remove biological contamination and to make the water as aesthetically attractive as possible. (See also section 2.2).

Treatment technology has been improving but it is clear that treatment alone cannot ensure that all drinking water is free from health risks. In fact, the very concept of avoidance of all risks is unrealistic, a point which needs to be explained to the public.

A leading USEPA official believes that available technology may now permit the virtual elimination of biological contaminants.

> "Water production systems using available technologies can be sited, built and operated to reduce the probability of consumer exposure to an infective dose to an extremely low and insignificant risk level. Thus in the case of biological contaminants of drinking water the goal of virtually no risk for all practical purposes is within reach in the case of a well designed and properly operated water production and distribution facility"5/

The director of the Zurich water supply, noting that Swiss treatment plants use sophisticated processes including pre-chlorination, ozonation, granulated activated carbon filtration and slow sand filtration, has stated that these water treatment plants have done almost all that can be done to purify drinking water. His view is that the emphasis should now be on wastewater treatment plants which need to be expanded and improved to preserve the quality of drinking water sources for future generations6/.

The issue here is to find the balance between prevention of pollution at the source and removal of contaminants in the treatment process. This issue comes more sharply into focus with respect to chemical contaminants, for which uncertainty remains about the ability of treatment plants to eliminate all organic and inorganic chemical pollutants. Hundreds of these substances have now been detected (at least at trace levels) in sources such as the Great Lakes. Whether or not these various substances need to be removed is a question, first of all, for the toxicologists, epidemiologists and other health scientists. If more advanced treatment is deemed to be necessary, however, considerably more research and testing of advanced treatment technologies will be required. Such research will be time consuming and expensive and the resulting treatment processes will probably be costly and may not be entirely foolproof.

On the philosophical level, most would agree that preventing a problem is preferable to solving one. Pollution control strategies, accordingly, are obviously sensible in economic terms if their implementation imposes a smaller economic burden on society than the burden of removing the pollutants from the water bodies at a later time. However it has to be admitted that we lack the information on which to make such decisions on economic grounds alone. There is therefore a need for governments to exercise judgement in devising pollution control strategies.

Senior levels of government - federal and provincial - need to be actively involved in the protection of drinking water sources through pollution control because local perspectives on this topic are much too narrow.

The overall goal of eliminating all waste discharges will forever be elusive but strategies to minimize contamination of our water bodies, particularly those used for drinking water, need to be formulated and actively pursued. Much has already been accomplished, but there is very much more to do.

Federal options include:

- acceptance of the existing arrangements for pollution control, including the water quality guidelines being prepared jointly with the provinces under CCREM (Section 3.3);
- expanding public information about existing problems and pollution control strategies.
- increasing research activities for water source protection and pollution control strategies;
- encouraging provincial authorities to undertake more research and to pursue vigorous pollution control programs which achieve demonstrable results.

5.6 Groundwater

The knowledge base about Canada's groundwater is quite limited. The federal government's interest in surface water resources is longstanding, originating from electric power and navigation interests. Only recently has the government begun to demonstrate its interest in groundwater.

Recent research indicates that some 27% of the Canadian population relies on groundwater as their primary source of domestic water supply. Provincial dependence on groundwater varies from 19% of the population in Alberta and Quebec to 100% in Prince Edward Island[7].

From a water supply perspective, there are three main issues:

a) Limited available information
To monitor and analyze groundwater resources is much more difficult and expensive than for surface water. Government understanding of available groundwater is weaker than of other underground resources (particularly oil and gas) and much less than in the USA, where the US Geological Survey has been very active over time. In other words, we don't know what we don't know about groundwater.

b) Availability of supply
If groundwater extraction exceeds the rate of aquifer recharge, the water table is lowered, which increases pumping costs and can cause wells to become dry. This "mining" of groundwater has been a major issue elsewhere (Mexico City and the Ogolalla aquifer beneath eight west-central states in the USA are two prominent examples). Such a water resource issue could have inter-provincial or even international implications if it arose in Canada. In this context, it should be noted that 1981 withdrawals by municipal water supplies and rural water supplies together amounted to about half the total groundwater use in Canada[7], the rest being used by agriculture and industry. Should the use by other sectors increase (for example, irrigated agriculture), those water supply systems dependent on existing aquifers might be threatened. Serious problems of this nature are not known to exist at this stage, but this could be due to limited knowledge about groundwater resources.

c) Groundwater quality
The quality of existing groundwater sources varies widely under natural conditions from place to place, depending on the materials in contact with the water and their solubility. In coastal areas, the matter of saline water intrusion into wells and boreholes is also a concern. But the principal quality issue concerns the degregation of groundwater by chemical contamination from man-made substances. Compared to surface water, groundwater moves slowly and is little improved in quality by exposure to air or by dilution. Contaminants in groundwater can accordingly become more concentrated than in surface water and the contamination is much less reversible. There have been several incidents of groundwater contamination in Canada[8].

The management of groundwater, like surface water resources, is primarily a provincial responsibility. We note, however, that USEPA has produced a national strategy on this topic which may be relevant for Canada (Section 4.3).

Federal options include:

- acceptance of the present situation;
- cooperating with the provinces in research and planning activities;
- undertaking research to develop a more thorough understanding of actual and potential groundwater problems on a national scale;
- considering and recommending resource management strategies for groundwater.

5.7 Research Needs and Priorities

In general terms, the nature of the water supply problems facing Canadians has changed considerably in the past generation. Prior generations were mainly concerned with obtaining piped water supplies which were aesthetically attractive and free of disease-causing pathogens, despite the continuing discovery of additional microbiological contaminants. The present generation now expects their water supplies to meet these basic criteria and also to be of the highest possible quality, free of toxics and other chemical contaminants which are being discovered increasingly in surface and ground waters which are used as water supply sources.

The need to be concerned about man-made pollutants is a relatively new phenomenon for Canadians. It has to be admitted that we are at a very early stage in determining how best to cope with the perceived threat to health. We need to be able to answer a complex set of questions including:

- what contaminants exist in our sources of drinking water?
- where do they come from?
- are they persistent?
- what is their potential impact on our health in the long term?
- what are the associated risks, expressed in terms of probability of the occurrence of such hazards?
- how can these hazards best be reduced?
- what criteria should be adopted to determine when a water source is unfit for use?
- what treatment technologies should be utilized to render existing water acceptable to drink?
- how can we be assured that our treated water supplies are operated to provide water of consistently high quality?
- what emergency measures are available in the event of our water supplies becoming temporarily or permanently unacceptable as a source of drinking water?
- should we consider separate water supply systems, one for drinking water and the other for all other domestic uses?

These and a host of related questions are being faced by Canada's water supply industry, which consists essentially of a large number of independent and locally operated systems. Technical and financial support is provided to these systems by the provincial and federal governments. Its decentralized nature makes it difficult for this industry to pose and answer the many questions which need to be addressed.

The basic and applied research which is required to answer these important questions is enormous in scope. Such research is very expensive and time consuming. Priorities need to be established in order to make the best use of available research dollars. Cooperation is essential in order to avoid the twin pitfalls of duplication and omission of research efforts by the various parties, particularly the provincial governments who retain the fundamental responsibilities for supporting services in this sector.

Pragmatic arrangements presently guide the research on water supply which is underway in Canada, with limited coordination and no overall policy. The federal departments of Health and Welfare and Environment each collaborate with their provincial counterparts. Health and Welfare takes the lead in drinking water while Environment focuses on the protection of water quality in lakes and rivers. The research roles of universities, water utilities, medical facilities, equipment manufacturers and others are less clear. The lack of central focus and direction on research matters makes it difficult to be certain exactly what is being accomplished but our enquiries indicate that total expenditures on research by all parties related directly to drinking water supplies in Canada might be of the order of some $ 5 million yearly.

Canadians may be fortunate that they are one of the latest of the industrialized countries to become concerned about the water quality problems. Our abundance of water resources, our small population and our modest industrial base are all factors which have shielded us from such problems, compared to many other countries. In consequence, much can be learned from the available experience of these other countries.

Canada's water supply industry should be aware of what research is underway in the USA because many are members of the USA-based AWWA. In fact the current vice-Chairman of the AWWA Research Foundation is Canadian. He advises that the budget of AWWA's Research Foundation, which was very modest in earlier times (typically $ 50,000/year), jumped to $ 500,000/year in fiscal years 1982 and 1983 and to $ 2 million/year for fiscal years 1984 through 1986. Half the funds in the current three years are being provided on a matching basis by the US Congress. AWWA hopes to increase the budget of the Research Foundation to $10 million yearly by 1995, with the entire sum being funded voluntarily by assessments to utility members[9]. Thus the North American water supply industry, through AWWA, has begun to actively address research questions on an expanded scale.

A few officials of the federal government are involved in scientific and technical exchanges which take place on a limited scale under the auspices of the World Health Organization, International Water Supply Association and other international bodies but the industry, in general, does not appear to be very well informed about research activities outside North America.

If it is admitted that the problems of safeguarding drinking water quality loom large ahead, and that we are in the early stages of deciding how best to act, then it follows that concerted efforts are needed to determine needs and establish priorities for research in this area. It seems to us that the federal government could play a significant role on

this matter in Canada, at a minimum in coordinating the necessary research. More active roles can also be envisaged, assuming provincial consensus, particularly in the funding of agreed research.

It would be helpful to have some agreed criteria concerning the level of expenditures on drinking water research. One possibility would be to relate these amounts to capital expenditures, which are of the order of $ 2 billion yearly. A research funding level of 1% of this amount, or some $ 20 million yearly, would not be unrealistic in light of the problems perceived and the public concern over water supply matters. Such a sum, equivalent to less than $ 1.00 annually for each Canadian, seems to be several times larger than the amount presently being spent in research on this topic.

Another point to consider is that local water supply authorities should have a major voice in determining research priorities because they deal with water supply problems continuously and are correctly perceived by the public as the principal institutions in the sector. The public at large, effectively the consumers of the services provided by local utilities, should also have a voice in determining research priorities and programs.

Federal options include:

- acceptance of the present situation;
- consultation with other levels of government and industry groups to determine future research priorities and funding mechanisms;
- expanded information programs to publicize existing and future research programs;
- encouraging provincial and local governments to increase their resources committed to research activities;
- expanding federal support for water supply research.

5.8 Water Supply Equipment and Materials

Water quality is substantially affected, accidentally as well as deliberately, by the various systems used to treat and distribute it to consumers. Lead pipes, for example, are no longer installed to carry water because water can remove and transport lead, which is toxic.

There are no purity requirements for the chemicals used in water treatment in Canada, of which an estimated one million tons are used annually[10]. This makes it possible for water utilities to be introducing unexpected contaminants into drinking water at the same time they are attempting to improve the water quality.

Point-of-use treatment devices, such as water softeners and water filters, are used by consumers who are concerned with drinking water supplied by water utilities. For example, about 3% of Canadian homes use water filters[11], of which about half are activated carbon filters. Health officials are concerned about the possibilitities of bacterial growth on the filters, including pathogenic organisms known to survive chlorination treatment.

Federal options include:

- acceptance of present situation which includes encouragement of industry to regulate itself and devise a code of practice;
- encouragement of control or regulation of these matters by provincial governments;
- setting up of mandatory standards and forcing compliance through federal regulations.

5.9 Operational Performance of Water Utilities

Canadians have invested many billions of dollars in their water supply systems. The replacement costs for existing water supply systems has been estimated at $ 62 billion and for wastewater systems at $ 47.5 billion, indicating total costs in excess of $ 100 billion if all systems had to be replaced[12].

The massive investments already made by Canadians in water supply systems reflects the very high value placed on this service. It also indicates a valuable investment which warrants sound management in order to be protected.

Water supply systems are generally planned and operated by local authorities. In the large metropolitan areas these authorities have fairly large numbers of staff, including professional and technical cadres who specialize in water supply. In medium and smaller sized communities, with smaller staffs, there is much less specialization and much less expertise. In the smallest communities (almost 3,000 have less than 10,000 residents, according to Table 2.2) the operating staff often consist of a few people with limited education, whose training consists mainly of unguided practical experience. Such operating staff may be responsible for several local services (for example, garbage collection and road maintenance as well as water supply).

Effective utilization of a water supply system, even the most simple, demands good standards of operation and maintenance after the scheme is planned and constructed. Water supply experts across Canada know that there is considerable room for improvement in the way many water systems are operated, particularly in smaller communities. Premature obsolescence of equipment is one obvious result, with associated and unnecessary extra costs. Less obvious, mainly because the quality of treated water is hardly monitored, is the failure to produce the best possible quality of water from the available treatment facilities.

There is usually a high percentage of "unaccounted-for" water in most water supply systems. This is water which is pumped from the source and treated but not accounted for in terms of sales to consumers. Much of this water - which can amount to 25% of the water produced, or more - is actually lost through leakage in the system or through unmetered consumption. Investments in additional source facilities and pipelines can frequently be deferred if utility operating staff can reduce the quantities of unaccounted-for water.

It is likely that more effective use could be made of many existing water supply facilities, including treatment plants as well as transmission and distribution systems, if operations and maintenance were improved. In other words, additional emphasis on operational performance can be cost effective and can defer or avoid additional capital expenditures. But such improvements require concentrated efforts by qualified operational experts.

As water treatment becomes more sophisticated, in line with the deteriorating quality of water sources and the increasing demands of consumers, more operational expertise will be required.

No uniform system of qualification exists for water utility staff in Canada, although the larger provinces have some training programs and courses for utility staff are offered at several technical colleges[13]/. Material for a training program for water supply operators is being prepared by FACE for a federal/provincial group but no national program exists yet to implement training programs based on this training material.

Several provinces and most American states have implemented a program to classify their water and wastewater systems and to certify the operating staff. The basic objective of this process is to improve operating and maintenance standards in these systems. A related benefit is the enhancement of the status and mobility of certified operators.

Standard criteria have been developed for facility classification and operator certification by the Association of Boards of Certification for Operating Personnel in Water and Wastewater Utilities (ABC), an organization based in the USA of which all provinces except Newfoundland are members. The ABC criteria divide systems into four groups; water distribution, water treatment, wastewater collection and wastewater treatment. Each group has four classes of facility from I to IV, with IV being the most difficult. Similarly operators are certified by group, according to the type of facility, and by classification, according to experience, education and examination. ABC has estimated that there were about 73,000 certified operators in North America in 1981.

In 1981 four provinces had voluntary certification programs for operators. (In the United States, all 50 states have either mandatory or voluntary certification programs). British Columbia, which in 1970 became the first province to introduce certification, was the only province which then required the operators to be examined*/. Operators in Alberta, Saskatchewan and Manitoba were certified on the basis of experience and education only. Alberta was expected to be the first province to make operator certification mandatory[13]/.

Ontario had developed a voluntary certification program which had been proposed for implementation early in 1982. New Brunswick, Nova Scotia and Prince Edward Island were also considering operator certification programs for implementation in the future.

*/ Present arrangements are understood to be similar to those reported in 1981.

In 1981 the four provinces of British Columbia, Alberta, Manitoba and Nova Scotia had a reciprocal agreement under the sponsorship of FACE which allowed for recognition of operator certification between these provinces. This is another step in the process of encouraging operating staff to improve their qualifications since the credentials are becoming more transferable.

Several smaller provinces have sought more federal support for training programs for water supply staff[14]/. It seems evident that there is scope for federal support for provincial and municipal efforts to improve the qualifications and performance of operating staff in the water supply industry.

Federal options include:

- acceptance of the existing situation;
- expansion of support to coordinate efforts to prepare training materials and programs, preferably through FACE;
- encouragement of mandatory provincial programs to train and certify operating staff and to classify water supply and wastewater systems;
- development of a federal training program and certification systems for operating staff.

5.10 Capital Requirements

Approximately $ 2 billion annually have been spent in recent years to expand and improve Canadian water supply and wastewater systems (Section 3.4). Estimates of future capital requirements in this sector are not presently available but can be expected to be of comparable magnitude, if not larger.

Much of Canada's water supply and wastewater infrastructure is aged and in need of rehabilitation. One estimate suggests that the replacement cost of existing systems could total over $ 100 billion[15]/. If only 10% of the facilities need to be rehabilitated over the next ten years, or 1% per year, the indicated costs for rehabilitation would amount to some $ 1 billion per year.

Another indication of the needs for system rehabilitation is provided by the Canadian municipalities, whose 1984 survey on this topic suggested that roughly $ 186 per capita is required, on the average, to bring essential water supply facilities up to acceptable condition for larger municipalities and $ 212 per capita for wastewater facilities[16]/. This preliminary estimate of some $ 400 per person indicates capital costs of some $ 8 billion for facilities rehabilitation to serve 80% of the total population or a figure of $ 800 million per year if spread over the next ten years.

Reliable estimates of future capital expenditures for water supply and wastewater systems do not exist on a national basis. The foregoing figures indicate that annual expenditures between $ 2 billion and $ 3 billion (or from $ 80 to $ 120 per capita per year) seem realistic, of which some

one-third would be for the rehabilitation of existing systems. Local municipalities are realizing, individually and collectively, that they lack the resources to finance such infrastructure.

Sources of funds to meet these massive capital expenditures by the municipalities include:

a) Increased user charges (tariffs) for water supply and wastewater services;
b) Increased revenues from local taxes, generally property taxes;
c) Increased general borrowing by means of debentures;
d) Increased borrowing from provincial or federal governments;
e) Increased grants from provincial or federal governments.

The question of how and where the local authorities can obtain the required funds deserves considerably more study. It is likely, however, that the federal government is going to receive increasingly strong pleas to provide capital for these systems, such as:

a) supporting the basic infrastructure needed for public health and economic development;
b) reinstituting and expanding capital assistance programs of earlier times (Section 3.4);
c) creating employment in locations throughout the country.

As these probable requests for federal assistance are enunciated, the federal government has a range of options, including:

- no action or response;
- encouraging provinces and municipalities to exhaust all other funding sources while refusing to provide funds for systems which are not a federal responsibility;
- providing funds through ad hoc programs, as in the past, with little attention to criteria and conditions related to such funding;
- agreeing in principle to provide limited financial assistance, on a cost-shared basis, on the basis of explicit criteria and conditions for such funding.

5.11 Economic Considerations

Conspicuously absent from virtually all of the considerations about drinking water issues in Canada is the concept of economics. Economics is about the allocation of scarce resources. Water, in its natural condition (before being processed for use by people) is generally not scarce in Canada. To process the water and distribute it to residences and work places, however, requires huge quantities of money. Canada's drinking water supplies, already quite good, can be improved to any desirable standard provided there is no scarcity of financial resources. That is where economics should be considered, to assist in allocating scarce financial resources to provide the quantity and quality of water which people desire.

Are people who claim they want higher standards of water supply service prepared to pay for these improvements? If so, there is no intrinsic reason for not proceeding with such improvements and charging the consumers accordingly. The issue is complicated by the institutions and mechanisms involved in the water supply industry. In other words, the market is imperfect: demand signals are poorly communicated to the suppliers, which are always monopolists.

Water supplies are generally provided by local authorities, who obtain capital funds from several different sources, including loans and grants from the provincial governments, which in turn have been massively subsidized by various federal programs. The prices at which water is sold to the consumers seldom reflects the true cost of providing the service because of various distortions in the pricing system, many of which are introduced by senior levels of government. Capital subsidies are one such distortion. Regulatory controls on water charges is another. Subsidization of operating costs by local governments is yet another common distortion. The net result is that consumers seldom see a clear link between standards of service and prices actually paid for the service of water supply.

The federal government's failure to cause provinces and municipalities to consider the issue of water pricing, while having provided vast sums for the construction of new systems and for the analysis of current and future problems, is a contributory factor to the lack of appreciation of the economic dimensions of safeguarding Canada's water supply. Water supplies are used without the consumers appreciating their true costs, particularly the costs of safeguarding the quality of the water. Water conservation is accordingly discouraged, further increasing the costs for wastewater disposal as well as for supplying additional water (at increasingly high unit costs).

Oil and gas supplies in Canada were being squandered until they began to be priced, within the last decade, at levels which reflected their economic value as determined by global supply and demand. Water is also a commodity whose demand depends on the price at which it is sold. Such prices should reflect opportunity costs, which are locally determined.

Since there is so much admitted uncertainty about the water quality questions confronting water supply authorities, and since regulations based on scientific evidence cannot really provide all the guidance the public wants, it is appropriate to place more reliance on expressed consumer demands. This in turn requires improvements in market mechanisms and pricing to assist in communicating proper price signals to consumers.

If this principle is accepted, as it must be eventually in a democratic society, there is considerable scope for action by the federal and provincial governments. Along with the local water supply authorities they should continue to undertake scientific research into the health impacts of alternative standards of water supply and to place more emphasis on estimating the costs of providing water at these alternative standards. Water supply consumers should be expected to contribute towards these research costs. Information about the linkages between costs and standards of service should be clearly communicated to the consumers, who will

eventually pay for the water through one means or another. Any federal programs which provide support to the water supply sector should emphasize the economic aspects and encourage consumers to pay for the standards of service they desire.

It is folly to pretend that all relevant matters about drinking water quality can be expressed in economic terms. Protecting water sources, for example, involves a multiplicity of strategies and costs which cannot easily be translated into higher prices for water supply, in part because such environmental protection provides many other benefits as well. Nevertheless, the need to introduce and emphasize the economic dimensions to the question of safeguarding Canada's water supply is paramount and governments should provide the necessary and overdue leadership.

Federal options include:

- continuation of the present situation;
- increasing research into the economic aspects of water supply and pricing;
- publicly and privately encouraging provinces and municipalities to concentrate on the economic aspects of water supply and wastewater disposal;
- witholding further funds for infrastructure until being satisfied that the authorities responsible for systems funded will sell their water supply and wastewater services at economically sensible prices.

5.12 Water Supply Emergencies

Water supply is an essential service in all Canadian communities. A contaminated water supply could jeopardize the health of all citizens in the community. Canadians are extremely dependent on their public water supplies yet are vulnerable, more so than is often acknowledged, to a wide range of potential emergencies.

Breakdowns in supply are one common problem, caused by routine or exceptional operating situations such as pipeline breaks, pump damage, and the like. Necessary repairs can usually be made by the water utilities in a matter of hours, or occasionally days.

Water shortages occur, usually in the summer, when peak demands exceed system capacity and/or available sources. Water rationing is often imposed, with little hardship, by means of restrictions on car washing and lawn watering.

Other potential emergencies could be much more serious. A useful study of the North Atlantic Treaty Organization listed potential causes of water supply emergencies, in descending order of likelihood, as follows:-

- undetected deterioration in the physical apparatus;
- human error;
- power failures;
- adverse weather;

- willful mischief;
- earthquakes; and
- war.17/

All communities are vulnerable to such water supply emergencies. Plans for dealing with them should be made before they arise. Emergency Planning Canada is the federal organization which supports and stimulates provincial and local governments to prepare for emergency situations. Most provinces have legislation requiring emergency response plans for essential services and many municipalities assign responsibilities for emergency planning to elected and/or salaried staff (often the fire department). However Emergency Planning Canada follows an all hazards approach and provides no specific sensitization or training concerning water supplies.

The federal government could assist provincial and municipal governments to prepare suitable contingency plans by means of several actions. Federal options include:

- doing very little, as at present;
- publicizing the need for such planning;
- undertaking risk analysis and providing training for provincial and local government officials;
- encouraging the provinces to assist local utilities in these endeavours.

6.0 CONCLUSIONS

This chapter draws together the main conclusions which stand out from this overview of the water supply situation in Canada and which lead to our recommendations in the final chapter.

6.1 Status of Drinking Water Quality in Canada and Perspectives

Maintaining the very high standards of water quality to which Canadians are accustomed requires continuous high standards of system operation and constant vigilance.

The microbiological quality of drinking water continues to be the most important determinant when considering the public health aspects of drinking water. Improved water treatment technologies, particularly disinfection, have more or less eliminated the major epidemics, particularly cholera and typhoid, have killed many thousands of Canadians in the era up until about 1915. Threats to public health arise from recently discovered waterborne diseases such as "legionnaires disease", giardiasis and viral diarrhoea as well as from occasional outbreaks of earlier diseases such as typoid, shigellosis and salmonellosis.

Data on the number of people currently being afflicted in Canada by waterborne disease are poor because the reporting systems fail to record all cases. Deaths are rare but there are probably upwards of 2,000 disease cases yearly which can be attributed to microbiological pathogens in our water supplies. In the USA, where statistics are more comprehensive, authorities note that outbreaks of waterborne disease are being reported with increasing frequency. This may be attributable to improved reporting procedures.1/

Water, the universal solvent, contains a wide array of chemicals in its natural condition. The chemical quality of water varies from place to place because of the different environments through which various water sources pass. Consequently the chemical quality of drinking water supplies differs widely across Canada. Existing drinking water guidelines (1978) recommend concentration limits in treated water for 52 substances, including some 18 inorganic and organic chemicals and 16 other organic substances.

These national guidelines are not enforceable (although Quebec has a similar set of enforceable regulations) and available evidence suggests that present arrangements for monitoring water quality do not check for all of these parameters in most parts of Canada.

1/ All references are listed in a separate section at the end of the report, beginning on page 85.

Many chemicals not covered by existing guidelines, particularly synthetic organic chemicals, are being discovered in the water sources which are used for supplying drinking water. Several of these discoveries have clearly indicated serious pollution of local sources, particularly groundwater, by very high concentrations of chemicals.

The more widespread concerns, however, are caused by the presence of chemical substances in very low concentrations in water bodies. For example, the Great Lakes, the drinking water source for roughly one third of all Canadians, have been found to contain some 800 toxic compounds.2/ These chemicals are being discovered because of rapid advances in analytical capabilities and because many man-made chemicals have been allowed to enter the water bodies. Our knowledge of the health impacts of such chemicals is limited at this early stage. Very little data exist, for example, about the possible presence of these chemicals in drinking water supplies after treatment, although 83 chemicals were found recently in Toronto's water supply.3/ More importantly, the possible impacts of such chemicals on human health is hardly known. Laboratory experiments have demonstrated that some of these chemicals can be carcinogenic but the research necessary to isolate their impacts on human health, when present in very low concentrations in drinking water, is complex, time-consuming and expensive. Such research is underway in many locations, in Canada and elsewhere, but conclusive and comprehensive results cannot be expected in the near future. This means that many of these micro-contaminants pose an as yet indeterminate risk to human health.

Sharply focussed and expanded research efforts are required to help us better understand the hazards and risks associated with the various microbiological and chemical substances being found in drinking water sources. Concurrently there is a need for improved strategies to remove harmful substances through advanced water treatment.

The longer term solution to assuring the highest possible quality of our drinking water supplies requires that pollution control strategies be implemented so as to minimize the contaminants in water sources. This too requires focussed research and analysis in order to determine the most significant contaminants, from a public health perspective, and the most cost-effective methods for reducing them.

There is increasing public concern about water supplies. Except in remote and native settlements where water supply systems are primitive, concerns about the availability or quantity of the supply are increasingly being supplanted by concerns about water quality and the risks to human health caused by the increasing attention to contaminants in water supplies. The federal government, particularly Environment Canada, is in some measure responsible for increasing this concern through the publication of its research concerning water quality in Canada's lakes and rivers. This enunciation of the problems, while discomforting to some, is a necessary and valuable service.

Citizens expect their experts, who in the case of water supply and public health are primarily public sector officials, to be able to define and minimize the risks associated with the various materials discovered in water sources. The fact is, however, that the best-qualified and

well-intentioned of public officials cannot possibly provide answers which completely satisfy the public and remove their concerns. The result is a growing lack of confidence by the public in government officials.

This lack of confidence in government officials has been noted in other but unrelated studies of the public's perceptions of governments' ability to provide service. While we cannot provide any direct empirical evidence of the link between public confidence and the provision of accurate water quality information, we share the concern that the public will grow more distrustful of government, in general, as more and more chemical contaminants are discovered without any credible and calming response from water supply and public health officials regarding their risk to human health. Eventually, there will come a time, in the not too distant future, when the public will demand to know more about the quality of water it drinks. We fear that at that time, if current practices are continued, the government will find itself without the kinds of answers it will need in order to provide for a sensible discussion of the problems.

Every person in Canada drinks water each and every day. Water quality promises to be a highly emotional public policy matter simply because it is difficult to understand. Effects are long term, a definite risk to human health is involved, and there is no simple solution. This suggests among other things a need for improved communications between public health officials, water supply authorities and the public.

6.2 Responsibilities for Drinking Water Systems

Responsibilities for water supply, including wastewater disposal and water quality management, are divided between the three levels of government in Canada. As a result, no level of government is in control of this critical topic. This helps explain why Canada does not have a national policy on the important subject of drinking water.

Provincial governments have the principal constitutional responsibilities for public water supply, mainly because the provinces retain the ownership of water resources within their jurisdictions. Water supply responsibilities are in turn mostly delegated to municipal and regional authorities but the provinces retain the role of regulating local public utilities, preserving the environment and ensuring that the public health of the people is not jeopardized by their supply of water.

Local authorities have the primary task of building, operating and financing the infrastructure systems on which the highly urbanized Canadian population is so dependent. The majority of the estimated 60,000 people who provide these sector services are employed by municipal and regional governments. These local authorities spend most of the roughly $ 2 billion which are invested annually to improve and extend water supply and wastewater systems.

The water supply industry consists primarily of the employees, consultants and contractors of the local government organizations which provide water supply and wastewater systems. These local bodies have limited perspectives and resources. Unfortunately the industry

associations - six regional associations and one federation of these associations (FACE) - are relatively weak and are linked to USA-based organizations, thus leaving Canada without a strong national association to represent one of the country's largest and most important industries.

The roles of the federal government in this sector are not clearly defined. Where the federal government is the landlord, on federal lands (such as the national defence bases and the national parks) or otherwise responsible for providing basic services (as in Indian reserves and, to a diminishing degree, in northern territories), the government has responsibilities analagous to those of the provinces. The federal government has a number of other activities in the sector which are related either to support for provincial governments or to looking after the national interest in matters of public health or environmental protection. However the basic mandate of the federal government in this sector has not been clearly spelled out.

An obvious consequence from this division of responsibilities for sector services is that there is a certain amount of confusion and inefficiency. Some problems which merit attention are overlooked or are not attacked effectively because of uncertainties about responsibilities and available resources (for example, water research, water quality monitoring, water pricing policies, water quality protection, and the like). Perhaps more importantly, individuals concerned about their water supplies are not clear where to address their concerns. They are apt to feel frustrated about lack of government concern and action.

There is a real need to be clear about the federal role concerning drinking water systems and water quality in Canada. Although our political system is different from that of the USA, recent experience in that country is instructive because they too have three levels of government which are involved with water supplies. Remarks by the USEPA Director of the Office of Drinking Water summarize the approach in that country:

> "Simply stated, the Safe Drinking Water Act of 1974 assigned responsibility to the federal government for research, standard setting and enforcement in the case of imminent hazard situations. Implementation responsibility -- making sure that the public water supplies conduct required monitoring and comply with all applicable standards -- rests with the State governments as long as they adopt requirements no less stringent than the federal standards. Where the States have not assumed these responsibilities, EPA enforces the program directly.
>
> To sum up, in the United States we adopted a federal role focussed primarily on research and the development of national standards. It has been our experience that there is not a significant resource base at the State level with which to conduct these activities. I think that standard setting with full public debate will continue to be one of our most important national functions. Program administration on the other hand seems managed at the State level."4/

6.3 Need for Cooperation Between Governments

No single level of government can resolve the water supply problems and issues facing Canadians. All three levels of government have been actively involved in providing the water supply and wastewater systems in service today, system which are, generally speaking, as good as those anywhere in the world.

There can be no room for complacency, however, as we shift our attention increasingly to the qualitative aspects of water supply systems across Canada. There is more need than ever for active cooperation by all levels of government to meet and solve complex questions which now confront the water supply industry.

Citizens expect the federal government to play a leading role in safeguarding Canadian drinking water, as clearly expressed in the many submissions received by the Inquiry. The way the federal government exercises its leadership needs to be carefully planned, however. A series of ad hoc programs and activities cannot suffice. Moreover the federal government has to acknowledge that the implementation and continuous operation of high quality water supplies and primarily the tasks of the provinces and municipalities. There is little place for unilateral federal action in this sector. What is needed is close cooperation between all levels of government, with the federal government's role worked out in close collaboration with the others.

The citizens of Canada, who ultimately pay all the costs of their water supplies, do not expect their governments to waste time and money in disputes over responsibilities in this sector. Canadians expect and deserve their governments to improve the arrangements by which they work together to provide the best possible services at the lowest possible costs.

6.4 Suggested Role for the Federal Government

We conclude that the role of the federal government in safeguarding Canada's drinking water supplies can be summarized fairly simply, to include the following responsibilities:

a) Representing Canada in all international activities related to drinking water supplies. In appropriate cases a federal delegation should include knowledgeable representatives from the provinces and the industry.

b) Supporting applied research, in cooperation with the provinces and industry, on all aspects of water supply and pollution control issues. In this context all federally funded research should be federally coordinated, forming a coherent and cohesive portion of a cooperative national research program.

c) Developing national guidelines for the quality of water sources before treatment and drinking water supplies after treatment, in cooperation with the provinces, with appropriate public input.

d) Implementing enforceable federal regulations for the quality of water sources and drinking water supplies on federal lands and, through various federal agencies, ensuring compliance with these regulations.

e) Supporting training activities initiated by the provinces and the industry to ensure that water supply and wastewater systems are effectively operated and monitored, along with contingency plans for emergency situations.

f) Maintaining national data banks on water supply and wastewater systems, on the quality of water sources and drinking water and on waterborne diseases throughout Canada.

g) Providing capital funds to share the costs of construction or rehabilitation of water supply and wastewater systems, provided there exists a demonstrated national interest and provided specified federal conditions are agreed in advance.

7.0 RECOMMENDATIONS FOR FEDERAL ACTION

Based on our review of the water supply situation in Canada, we suggest that there are a number of specific actions which can and should be undertaken by the federal government to safeguard Canada's water supplies. These suggestions are presented in the form of seven recommendations, which we believe should be endorsed by the Commissioners and incorporated in the final report of the Inquiry.

We have also given consideration to the means by which these recommendations can best be implemented. Our thoughts on these matters, along with a tentative timetable, are provided after the recommendations are explained.

A. SPECIFIC RECOMMENDATIONS

RECOMMENDATION ONE: DEFINITION OF FEDERAL ROLE

WE RECOMMEND THAT THE FEDERAL GOVERNMENT ISSUE A POLICY STATEMENT ENUNCIATING ITS FUTURE ROLE IN WATER SUPPLY AND WASTEWATER DISPOSAL. THE GOVERNMENT SHOULD ALSO SPECIFY NATIONAL OBJECTIVES TO BE ACHIEVED BY 1990 IN THE INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE.

Rationale

Provincial and local governments and the Canadian public generally need to be informed explicitly of the intended future role of the federal government in this sector.

At the same time the government should formally announce that Canada intends to meet specified objectives in the International Drinking Water Supply and Sanitation Decade which it has promoted and supported at the United Nations. This means that all Canadians should have access to safe drinking water and adequate sanitation by 1990.

Comments

The role we believe the federal government should undertake in this sector is summarized in Section 6.4.

In most parts of Canada the provincial and municipal governments have the basic responsibility for providing water supply and wastewater services and should have little trouble in meeting the objective of the International Decade. On federal lands and Indian reserves, however, the federal government has the necessary authority and should provide these basic services by 1990. Minimum standards of water supply and wastewater services would have to be established on Indian reserves, along with definitive programs to meet these service standards. It is clear that implementation of this recommendation will require extensive consultation with the Indian bands being served.

RECOMMENDATION TWO: RATIONALIZATION OF FEDERAL ACTIVITIES

WE RECOMMEND THAT THE FEDERAL GOVERNMENT TAKE STEPS TO RATIONALIZE ALL ITS ACTIVITIES CONCERNING WATER SUPPLY AND WATER POLLUTION CONTROL.

Rationale

We have observed that there is a lack of focus and coordination on water supply matters by the various federal government departments (Section 5.1), of which the two most significant are National Health and Welfare and Environment Canada. Federal activities in this sector need to be rationalized as an integrated part of safeguarding Canada's water supplies. This could result in improved coordination between departments, the reorganization of certain departmental sections or the creation of a new organization.

Comments

Prescribing the appropriate solution to the organizational problems which we have observed is beyond the mandate of the research paper. Various options have been suggested (Section 5.1) and these need further consideration. The experience in the USA, where an Office of Drinking Water was created within their national environmental agency, may be worth considering.

In any event the key people presently involved in water supply and wastewater activities in the various federal departments would be expected to remain active in this field. What is needed is an improved framework for the federal government so that their revised role can be carried out more efficiently. Particular attention needs to be paid in any rationalization to arrangements for coordination between the federal government and the provinces.

RECOMMENDATION THREE: STATUS REPORT AND DATA BASE

WE RECOMMEND THAT THE FEDERAL GOVERNMENT COMPLETE A COMPREHENSIVE REPORT, WITH THE COOPERATION OF THE PROVINCES, ON THE PRESENT STATUS OF DRINKING WATER SUPPLIES IN CANADA. INFORMATION ON WHICH THE REPORT IS BASED SHOULD BE SYSTEMATICALLY RECORDED IN A NATIONAL DATA BASE WHICH CAN BE UPDATED REGULARLY.

Rationale

Although Canadians are increasingly concerned about their drinking water supplies, the problems cannot yet be tackled in a systematic and comprehensive manner because the problems have not yet clearly been defined. Many individuals and organizations have expressed their opinions and concerns about drinking water quality, but few can provide documentary evidence of real problems. The federal, provincial and local governments would be unwise to make major changes in this sector until the problems have been systematically quantified and analyzed, to the extent practicable.

Furthermore, future research activities should be carried out on the basis of time series of data on the condition of water quality and water supply systems. This requires a consistent and reliable data base, including information on waterborne diseases.

We note that the 1974 Drinking Water Act was passed in the USA only after several national studies of the water supply situation. No such studies have yet been undertaken in Canada.

Comments

A thorough analysis of existing water supply and wastewater systems is needed to provide basic information on the present situation in all communities in Canada. Both types of systems should be analyzed because of the many linkages between water supply and wastewater services. The quality of untreated and treated water in all systems should also be documented.

The information required for each system should be comprehensive. Most of the necessary data already exist at the local level, particularly for the larger systems. Some data have been recorded at the national level in the MUNDAT and NAQUADAT systems of Environment Canada. However a more systematic approach is required.

Much guidance ought to be possible from a related AWWA activity which has recently begun. That association has initiated a project which has been summarized by its president as follows:

> "We intend to create the world's most comprehensive electronic data base about water utility operations. In fact, it will be the world's only such data base, complete with information about infrastructure, financial affairs, water quality, costs, and system operations. We'll first ask the 600 largest utilities to help establish the groundwork and polish the data-gathering techniques. Later, we will statistically sample the other estimated 59,000 utilities, down to and including the very smallest. The data we obtain will be invaluable for handling legislation, regulatory and general information inquiries".1/

Canadian utilities are expected to respond to the comprehensive AWWA questionnaire which has recently been completed. Only the largest utilities are being surveyed in the first phase, as their larger staffs make it most likely that the required information can be obtained promptly. Smaller utilities will be surveyed after the initial data are analyzed.

The detailed arrangements by which AWWA intends to gather, analyze and subsequently make available the new data are not yet clear. Canadian utilities should be encouraged to make their response to the AWWA questionnaire available to the provincial and federal governments as basic inputs to the sector status report.

A similar questionnaire concerning wastewater systems should also be planned and utilized in the status report and incorporated in the national data bank. At the same time the federal and provincial health departments should collaborate to collect and analyze data concerning health problems related to drinking water quality.

Close cooperation will be required from the water supply and wastewater industry and from provincial and local governments if the system analyses and establishment of a reliable data base are to be effective. Special consideration should be given to the planning and carrying out the initial analysis and for maintaining and updating the data bank in future. A system for obtaining, verifying, storing, updating and utilizing the data base should be planned from the outset. The data base should become a permanent feature, capable of providing accurate information to industry personnel and to the public on a continuing basis.

The results of the analyses of existing water supply and wastewater systems across Canada should be incorporated in a comprehensive report, including recommendations. This report should be published and made available to provincial and municipal governments and to the public at large.

RECOMMENDATION FOUR: EXPANDED RESEARCH PROGRAM

WE RECOMMEND THAT THE FEDERAL GOVERNMENT INCREASE ITS FINANCIAL SUPPORT FOR APPLIED RESEARCH ON WATER SUPPLY AND WATER POLLUTION CONTROL AND THAT SUCH FEDERALLY SUPPORTED RESEARCH FORM A COORDINATED PORTION OF A NATIONAL RESEARCH PROGRAM. AS AN INITIAL GOAL WE RECOMMEND THAT THE FEDERAL GOVERNMENT FUND 50% OF APPROVED RESEARCH IN THIS SECTOR UP TO A TOTAL OF $ 10 MILLION ANNUALLY BY 1990.

Rationale

Most experts familiar with the issue of drinking water quality admit that we face considerable uncertainty about the health and economic implications of safeguarding Canada's water supplies. Particularly difficult are questions related to the multitude of chemical contaminants discovered in water sources in recent years.

It has been estimated that Canadians are already spending some $ 2 billion yearly to construct water supply and wastewater systems and may have to increase these expenditures if existing infrastructure is to be preserved. Yet research expenditures in this sector are minimal and uncoordinated. There is a strong need to determine research priorities on a national basis and to expand research activities considerably, to an initial level of a $ 20 million research program nationally by 1990, 50% financed by the federal government. Concensus seems to exist that the federal government should take more initiative in this area.

Definite action is needed to concentrate Canadian researchers on drinking water quality problems in Canada. The first step should be to determine exactly what research is already underway and by whom. A national perspective on research needs is presently absent and the funds to support such research are also too limited. The federal government should

accelerate efforts in this area by agreeing to fund 50% of all relevant research, subject to cooperative arrangements being worked out with the provinces and the industry.

Local water utilities should be expected to contribute significantly in these research efforts in two ways. They should provide funding, perhaps by means of a research surcharge on each customer's account, and they should help determine research priorities and programs. New mechanisms are required to arrange for provincial and federal governments and expanded research capabilities have required to be developed throughout Canada.

RECOMMENDATION FIVE: GUIDELINES FOR WATER QUALITY

WE RECOMMEND THAT THE FEDERAL AND PROVINCIAL GOVERNMENTS SHOULD CONTINUE TO COOPERATE IN THE PRODUCTION OF NATIONAL GUIDELINES FOR THE QUALITY OF WATER SOURCES AND DRINKING WATER.

Rationale

Good progress is already underway by federal-provincial groups who are working to prepare two types of water quality guidelines which are intended for national use, one for water sources under natural conditions and the other for drinking water after treatment. The process should continue but should be refined to invite public participation. Some guidance may be provided by the process followed by USEPA.

After the national guidelines are finalized the federal government should cause them to become federal standards which are legally enforceable in areas of federal jurisdiction.

The principal impact of establishing enforceable drinking water standards will be on federal lands such as national parks and defence bases, where the federal government would adopt drinking water standards to which individual water supply systems must conform. Similarly enforceable water quality standards should be adopted for federal fresh water bodies, including those in Indian and Inuit lands which are claimed to be in the public domain.

Establishment of enforceable national standards by the federal government should not antagonize the provinces since the enforcement provisions would be limited to areas of federal jusrisdiction. At the same time, however, such enforceable federal standards would serve as a model to provincial governments who could be encouraged by their citizens, as well as by the federal government, to enact comparable provincial standards.

Comments

a) Guidelines for Drinking Water Quality

A federal-provincial working group on drinking water, under the Deputy Ministers of Health, is currently working to revise the 1978 guidelines with a view to publishing new guidelines sometime in 1985 or 1986. No public participation in this process is envisaged at present.

This working group should be required to publish these guidelines in draft by a specified date, say mid-1986. Thereafter public comments should be invited within a specified period of time, such as three months, before the guidelines are finalized. Public comments and working group reactions to these comments should also be published.

b) Water Quality Guidelines for Water Sources

A federal-provincial task force under the Canadian Council of Resource and Environment Ministers is in the process of developing water quality guidelines for eight different water uses, including raw potable water. The first national version of these guidelines for lakes and rivers is scheduled to be presented to CCREM before the end of 1985. This task force intends to make recommendations on future research priorities on existing scientific information and analyses, in Canada and elsewhere.

This task force should also give consideration to developing quality guidelines for groundwater, as well as surface water, to be used for potable water supply.

Public participation in this process should be encouraged. The water quality guidelines to be developed by the CCREM task force in 1985 should be published in draft and public comments should be invited within a specified period of, say, three months, before the guidelines are finalized. Public comments and task force reactions to these comments should also be published.

RECOMMENDATION SIX: SUPPORT FOR TRAINING PROGRAMS

WE RECOMMEND THAT THE FEDERAL GOVERNMENT PROVIDE INCREASED FINANCIAL SUPPORT FOR TRAINING PROGRAMS INITIATED BY THE PROVINCES AND THE WATER SUPPLY INDUSTRY.

Rationale

Canadians cannot be assured of obtaining high quality water supplies reliably unless the operating staff of the utilities are properly trained and motivated. Many individual provinces have difficulties in organizing suitable training programs and welcome federal assistance in this area.

The federal government has already assisted the provinces and the industry to develop training materials for wastewater operators (through Environment Canada) and water supply operators (through Health and Welfare), with materials produced in both cases by FACE. Further support is needed to make best use of these and possibly additional materials in a well planned and managed national program for operator training, which should also lead to a national program for operator training, which should also lead to a national program for operator certification.

Improved water quality control, including monitoring of treated water supplies on a systematic basis, will depend on staff who are well trained in consistent analytical methods. This too is an area where the federal government, in conjunction with the provinces, should play an important role.

Each water supply system in Canada should have a contingency plan for providing essential water supplies in periods of emergencies. The range of potential risks (natural and man-made) should be specified and plans implemented to minimize such risks. Arrangements should be planned to safeguard public health and minimize economic disruption pending the elimination of the crisis. The federal government should help to provide appropriate training in this matter, as it does in other areas through Emergency Planning Canada.

RECOMMENDATION SEVEN: FEDERAL FUNDING OF WATER SUPPLY INFRASTRUCTURE

WE RECOMMEND THAT THE FEDERAL GOVERNMENT BE PREPARED TO LOAN FUNDS TO PROVINCES AND MUNICIPALITIES TO HELP FINANCE THE CAPITAL COSTS OF CONSTRUCTING NEW WATER SUPPLY AND WASTEWATER SYSTEMS AND OF REHABILITATING EXISTING SYSTEMS, PROVIDED THERE EXISTS A DEMONSTRATED NATIONAL INTEREST AND THE RESPONSIBLE AUTHORITIES AGREE TO MEET FEDERAL CRITERIA AND CONDITIONS TO BE SPECIFIED BEFOREHAND.

Rationale

Hundreds of millions of dollars have been provided through various federal programs in the past to help provincial and municipal governments construct water supply and wastewater systems. It is probable that the federal government will be requested to continue to provide financial resources for such systems on a cost-sharing basis, even though it is clear that the basic responsibility for providing these services does not rest with the federal government. The federal government should be willing, in principle, to continue to help finance these systems by means of loans, but only if there is a demonstrated national interest and if specified federal criteria and conditions are met. This conditional arrangement would be similar, in principle, to the criteria for provincial participation under the Canada Health Act.

The basic criteria for possible federal capital assistance should be spelled out, with the objective of ensuring that all Canadians should have equal access to water supply and wastewater services of specified minimum standards.

The conditions of federal funding should also be specified, including repayment terms. The basic conditions for the provision of federal funds for such infrastructure should cover a number of key points, with technical and legal details to be worked out as appropriate and incorporated in the loan agreement. The federal government should not be willing to share routine operating or maintenance costs associated with existing or new systems, as such costs should be met by the local utilities from tariffs paid by the users of the services.

Comments

Federal conditions for sharing the costs of water supply and wastewater systems with provinces and municipalities should cover relevant points, including:

- participation in national data base for water supply and wastewater systems;
- enforcement of standards for the quality of raw potable water and drinking water which are no less stringent than the national guidelines;
- monitoring of treated water quality on all public water supply systems, including regular publication of sub-standard results and emergency publication of health-threatening conditions;
- cooperation in national program of operator training and certification;
- future operation and maintenance of existing and expanded systems;
- implementation of economically and financially sound pricing policies for water supply and wastewater services;
- water conservation practices including minimization of unaccounted-for water;
- adoption of realistic contingency plans for water supply emergencies.

Existing federal programs for funding of these services should not be extended or expanded unless the foregoing criteria and conditions have been agreed with the provinces in question.

No new program to provide federal funds for capital expenditures on new or existing systems should be provided until the government clearly establishes the criteria and conditions associated with any such funding. This recommendation does not apply to research and planning activities, which should be supported on their own merit.

B. IMPLEMENTATION OF RECOMMENDATIONS

We offer here some thoughts as to how these recommendations might be implemented by the federal government.

The first two recommendations can be implemented by the federal government without reference to any other governments. The last five recommendations require continuing cooperation with provincial governments. A tentative timetable for their implementation follows, assuming that the federal government can create the necessary inter-departmental mechanisms, such as special task forces for each recommendation, and have them fully operational before the end of 1985.

Recommendation One: Definition of Federal Role

This research report is expected to be published at least four months before the report of the Inquiry on Federal Water Policy and so it should have been carefully reviewed by federal departments concerned with drinking water quality by the time the Inquiry report is released. Accordingly we see no reason why the federal government should not be able to deal with Recommendation One by providing a policy statement to define the future federal role concerning water supply and wastewater disposal at about the time the Inquiry report is released, or at least within one month thereafter.

Recommendation Two: Rationalization of Federal Activities

This recommendation could be implemented in different ways. Were it not for the perceived rivalry between various government departments (and, for that matter, within large departments such as Environment Canada), one way would be to create an inter-departmental task force to examine the situation and make recommendations.

In this case we think it preferable to obtain such recommendations from more objective analysts, such as management consultants from the public or private sectors, after consultation with the departments involved. Recommendations for such a rationalization could be provided within about six months so should be available by early in 1986 if action is taken promptly. The time needed to implement the rationalization would depend, of course, on the nature of the suggested changes.

Recommendation Three: Status Report and Data Base

Action depends on cooperation with the provinces and the water supply and wastewater utilities. All necessary protocols and arrangements to undertake the work should be completed by mid-1986. This activity should be contracted out to a competent organization such as FACE. An interim report should be available by the end of 1986 and the final report by mid-1987. All reports should be made available widely, to governments, including representatives and the general public. The entire activity should be seen as a major exercise in public information and education.

Recommendation Four: Expanded Research Program

Further analysis is required of all research activities presently underway across Canada in this field, which should take about three months to collect and review. Thereafter the federal governments should convene a workshop of competent authorities in order to draft an expanded research program. Such a workshop could take place by mid-1986, with a drart report provided immediately thereafter for circulation and review by all interested parties. A final workshop in late 1986 could be the basis for defining an interim national research program for the period 1987-1990. The research program should be reviewed annually and a longer term program, covering the period 1991-1995, should be formally approved before the end of 1989.

Recommendation Five: Guidelines for Water Quality

Separate federal-provincial working groups are already busy with the drinking water guidelines and the water quality guidelines. Drafts of both should be made available for public comment, not later than mid-1986, following which they could be finalized and published before the end of 1986. The activities could proceed as separate components of the same program, with common procedures worked out beforehand by federal and provincial authorities.

The federal government should take action to create enforceable federal standards based on each guideline by mid-1987.

Recommendation Six: Support for Training Programs

A series of independent training activities are envisaged under this recommendation. It would be preferable to have them all proceed under the direction of a continuing federal-provincial committee or working group, with input from industry. In fact the existing FACE committee for certification, education and training could be a useful vehicle for this purpose. The timing and logistical arrangements for each training program would depend on the numbers to be trained, course contents and related factors. It should be appreciated that training (and re-training) activities need to be carried on more or less permanently because of the large numbers of people in the industry and the continuous turnover of staff.

Recommendation Seven: Federal Funding of Water & Wastewater Infrastructure

The federal government should decide, before the end of 1985, whether or not it is prepared to consider sharing the costs of municipal infrastructure in this sector. If yes, criteria and conditions to apply to such funding should be specified before any requests for this funding are entertained or approved.

C. MECHANISMS FOR FEDERAL GOVERNMENT COOPERATION

As has been stressed throughout this report, there is limited scope for unilateral federal action to resolve water supply and wastewater problems in Canada. Furthermore actual and perceived problems, and therefore the responses required by various governments, will continue to change over time. Mechanisms need to be established to encourage the necessary continuing dialogue on these matters between the federal government and the provincial and municipal governments. A wide range of possibilities exist, and should be examined. A permanent commission or regular meetings between public servants and elected officials at various levels of government are two possible alternatives.

As external researchers we see merit in institutionalizing the process by which federal and provincial governments, and also the local governments who actually provide water supply services, can meet on a regular basis to agree on cooperative actions. We note, for example, that the first ministers of Canada and the provinces have recently agreed to have regular, scheduled meetings to review topics of common interest.

For the purposes of discussion, review and hopefully action by the various levels of government, we recommend that the federal government propose and discuss with all parties the concept of an annual working meeting at which all aspects of federal government cooperation in the water supply and wastewater sector can be discussed with interested parties. We suggest that these parties include representatives from all provinces and territories (health, environment and/or resources departments as well as inter-governmental affairs departments), from local governments (perhaps through the Federation of Canadian Municipalities) and from industry associations (perhaps through FACE and its constituent organizations). We further propose that the federal government take steps to convene the first such working meeting as soon as can be conveniently arranged, tentatively before the end of 1985, that is within the next nine months.

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Annex 1

SUMMARY OF RELEVANT FEDERAL-PROVINCIAL WATER QUALITY AGREEMENTS

Annex 1-1 : Environment Canada
Water Quality Monitoring Programs

Annex 1-2 : Health and Welfare Canada
Health Protection Cooperative Activities

ENVIRONMENT CANADA

Water Quality Monitoring Programs

Administered by:

Water Quality Branch, Inland Waters Directorate, Environmental Conservation Service.

Purpose:

To assess the ambient quality of inland waters for municipal, industrial, commercial, agricultural, and fishery uses and to determine pollution levels including contaminants and toxic substances for federal and provincial governments and the private sector by providing water quality data and interpretive information in summary, detailed and special reports.

Authority:

Canada Water Act. Arrangements are made with the provinces as required. Also supports programs under the Environmental Contaminants Act, Fisheries Act, Boundary Waters Treaty Act, the Northern Inland Waters Act, the Arctic Waters Pollution Prevention Act, the Canada Shipping Act, the Navigable Waters Protection Act, and others.

Time Frame:

This is a continuing program which began in 1966. It is continually modified to take account of new pollution problems and users' needs.

Financing and Operation:

Under the Canada-Ontario Agreement Respecting Great Lakes Water Quality the federal government finances 50% of the Province's activities associated with the Great Lakes International Surveillance Plan (GLISP) in addition to its own activities in this area. Also a special arrangement with the Prairie Provinces Water Board provides for coordination of federal and provincial water quality monitoring in Manitoba, Saskatchewan and Alberta.

Initiatives are presently underway with the provinces to enter into cost and work-shared agreements for all water quality monitoring in Canada with a cooperative inter-change of data on water quality between the federal and provincial governments.

Payments:

Under the terms of the Canada-Ontario Agreement approximately $ 1,210,000 were paid to Ontario for GLISP.

When the agreements with the provinces on water quality monitoring are signed and fully implemented by 1986-87 it is anticipated that they will represent intergovernmental payments of approximately $ 2,000,000 of which about $ 300,000 will be payments to provinces for work done for the federal government.

It is estimated that approximately $ 5,000,000 may be of economic benefit to the provinces through the production of water quality data reports and special computer printouts.

HEALTH AND WELFARE CANADA

Health Protection Cooperative Activities

Administered by:

Various divisions of the Health Protection Branch.

Purpose:

These activities of the Department of National Health and Welfare with the close cooperation of the corresponding provincial agencies are all aimed at increasing health protection by expanding the impact of federal activities in the surveillance and correction of existing or potential health hazards and poor health practices, and in the dissemination of information about these hazards and practices.

Authority:

Generally, the Department of National Health and Welfare Act, the Food and Drugs Act and Regulations, the Narcotic Control Act and Regulations, the Radiation Emitting Devices Act and the Hazardous Products Act. Informal agreements between the Health Protection Branch and the provincial health agencies concerned in each activity.

Time Frame:

These are all continuing programs:

Financing and Operation:

The Department of National Health and Welfare is concerned with protecting the health of Canadians. To further this objective the Department carries out a wide range of activities to identify, publicize and eliminate conditions which are dangerous to the population's health.

Some of these programs are carried out entirely by federal staff, others with private institutions such as universities and hospitals or practising doctors, and still others in cooperation with the provincial governments. Some of the projects with agencies outside the federal government, especially in the private sector, are carried out under contract. Others involve no exchange of funds but do involve agreements on the assignment of resources. The twelve health protection activities in which provincial cooperation is of particular importance are:

1. Environmental Health;
2. Food Safety and Nutrition;
3. Provincial Pesticide Residue Laboratories;
4. Laboratory Centre for Disease Control;

5. Methadone Control Program;
6. Drug Quality Assessment Program;
7. Authorization to Possess Narcotic and Restricted Drugs for the Purposes of Analysis of Physicians;
8. Purchasing, Prescribing and Dispensing of Narcotic and Controlled Drugs;
9. Disposition of Drugs and Assets Seized by Police Departments;
10. Prosecutions Under the Federal Drug Statues;
11. Provision of Expertise and Training Aids to Assist Municipal and Provincial Law Enforcement Agencies;
12. Exchange of Information.

A paragraph outlining the first of these activities follows:

Environmental Health:

The Federal-Provincial Advisory Committee on Environmental and Occupational Health was established in June 1978 to advise Ministers and Deputy Ministers of Health on all matters of environmental and occupational health including risk identification, standards, provision of services and control measures, and on related policy and programme options, with due regard for respective jurisdictions and responsibilities, and with particular consideration of appropriate health actions associated with:

- contamination of food, air, water, and land by physical, chemical, radioactive and other substances;
- urban, industrial and other waste disposal activities, effluents, and emissions;
- new chemical compounds and operational innovations;
- physical, chemical, radiation and other health hazards of work environments;
- personal health services provided at the work-place;
- other factors as concerns and priorities may dictate.

Specific activities are carried out by a federal-provincial sub-committee and various Working Groups, e.g. development of programs for the health and safety of laboratory workers; development of guidelines to control risks for women in industry; guidelines for recreational water quality; guidelines for wastewater disinfection; guidelines for indoor air quality; guidelines for occupational and environmental noise and update of the "Drinking Water Guidelines, 1978"; development of criteria documents on bio-assay and in vivo monitoring; preparation of a compendium of methods for the analysis of drinking water; development of radiation Safety Codes (x-rays, microwave, use of radio-nuclides, ultrasounds, short-wave diathermy) have also been discussed; "Guidelines for Recreational Water Quality", "Health and Safety of Laboratory Workers in Canada - a review of the literature", "Guidelines for Toxic and Hazardous Chemicals Used in Educational Institutions", "General Guidelines for Bio-Assay Programs", have been published.

Other activities are carried out by the Environmental Health Directorate upon request and/or in collaboration with provincial authorities, some of which include: analyses of blood of exposed workers for PCBs, and the analysis of airborne dust samples in support of provincial industrial hygiene programs. In addition, drinking water samples have been examined for trihalomethanes, asbestos, gasoline and PCB content. Surveys and studies have been conducted to determine whether air pollution in Sydney, Nova Scotia adversely affects human respiratory health; to determine background radon levels in homes across the country, to conduct a safety assessment of electromagnetic radiation (microwaves and radiofrequency) emissions from the CN Tower in Toronto, to determine radioactive waste levels.

Payments:

No funds are transferred either to or from the provinces under these activities. Cost sharing is achieved by each level of government carrying out part of the activity and absorbing the corresponding expenses. However, the hospital based programs such as poison control centres and methadone treatment centres can be shared under the Hospital Insurance and Diagnostic Services Act. Medically required services rendered by medical practitioners related to such programs are shareable under the Medical Care Program.

ANNEX 2

TERMS OF REFERENCE

TITLE: Report on Safeguarding Canadian Drinking Waters

OBJECTIVE:

The objective of the assignment is to explore the policy implications for the federal government of alternative approaches to safeguarding Canadian drinking water quality.

The contractor hereby agrees to:

1. Review current federal and provincial legislation, regulations and guidelines on drinking water quality against emerging scientific findings and public concerns about contaminants.

2. Review experience in other countries, especially in the United States where a federal Safe Drinking Water Act is in force.

3. Consider alternative courses of action which the federal government could pursue, in terms of research, legislation and financial support, and the implications of these on affected interests, including other governments.